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PEANUT RESEARCH

SOUTHERN UTILIZATION RESEARCH
AND
DEVELOPMENT DIVISION
NEW ORLEANS, LOUISIANA

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A LIST OF PUBLICATIONS WITH ABSTRACTS
reporting utilization research conducted

at the

Southern Utilization Research and Development Division
Agricultural Research Service
U. S. Department of Agriculture

on the

Chemistry, Biochemistry, Processing and Utilization of Peanuts

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RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION BENEFITS PEANUT INDUSTRY

Peanut research by the Southern Utilization Research and Development Division has always been highly productive, but never more so than in recent years. Three widely divergent lines of work have yielded important findings.

A new product, partially defatted peanuts, has been extensively commercialized in different parts of the country since it was first announced a few years ago. The product, and the process by which it is made, are described in technical publications listed here.

Early investigations of mycotoxins are also reported. This research focussed first on peanuts, and was concerned chiefly with studies of aflatoxin, a substance elaborated by the microorganism, *Aspergillus flavus*. This work has become an integral part of a worldwide investigation of mycotoxins in agricultural products. Standards containing known amounts of aflatoxins B_1, B_2, G_1, and G_2 have been supplied to researchers in many parts of the world, to aid them in their own investigations. Highly sensitive methods of analysis have been developed, some of which can be modified for application to other products. The analytical methods in particular have been used in the quality control program put into effect voluntarily by the peanut industry in this country, in cooperation with various government agencies. Several methods for the destruction or removal of aflatoxin have been developed, and studies along these lines are being continued. Research on other phases of the aflatoxin problem is continuing also, and some of the projects underway already give promise of useful and interesting results.

A large volume of basic information on seed proteins has been developed through pioneering research at the Southern Division. Peanuts were chosen as the subject for much of this research because their structure is peculiarly well adapted to such studies. Investigation of the subcellular distribution of various substances in peanuts reveals that starches, proteins, and other substances are largely segregated into individual "packages" within the peanut kernels resulting in a high degree of compartmentalization. Again, information developed through research on peanuts has proved applicable to other oilseeds. Extensive studies have been made also of biochemical changes that occur during germination, and new information on enzyme systems has been developed.

Investigation of the effects of heat on peanut protein revealed that protein deterioration can be measured by following the change in the *epsilon*-amino lysine groups. This method is now used widely to measure nutritive values of proteins because results agree well with those of feeding tests.

Papers describing these and other recent developments pertaining either directly or indirectly to peanuts and peanut products are listed here, and are much in demand. There is also much current interest in results of earlier research at the SURDD on peanuts and peanut products as reported in the various publications.

One of the first projects undertaken was research to improve the quality of peanut oil for use in salad dressings, mayonnaise, and other food products, and for some industrial uses. For most purposes, the properties of peanut oil required modification by some treatment, such as hydrogenation; winterization; molecular distillation; saponification and re-esterification; or interesterification. Application of these processes to peanut oil was explored. Researchers demonstrated that peanut oil can be hydrogenated in such a manner that part of it resembles olive oil in the processes required for its use as a textile lubricant. It was also found that an oil excellent for sulfonation can be produced by esterifying the acidulated soapstock remaining after refining of peanut oil.

Investigation of possible industrial uses of the peanut solids left after extraction of the oil led to some interesting developments, of which the most important, perhaps, is a method for the extraction of a light-colored protein. At that time it was demonstrated that this protein could be spun into a fibrous form or used in a variety of other products, such as plywood glues, rewettable glues, paper coatings, sizing material for window shades, and other uses of potential value for industry.

Much more important at the present time, however, is the potential of this light-colored protein material for food uses. This is particularly true in many areas where protein supplies are inadequate, as they are already producing peanuts in significant quantities. It has been suggested also that the peanut protein fibers could be used to give texture to food products.

During this time a great deal of information was developed on the chemistry and behavior of peanut oil and protein, and on the influence of processing variables on quality. Use of solvents to extract oil from oilseeds was being widely adopted, and this process was adapted to peanuts.

For many years peanut butter has been the largest single outlet for peanuts in this country. Recognizing the need of processors for accurate information to guide them in their operations, scientists at the SURDD undertook a systematic study of the variables affecting the quality of peanut butter. These studies resulted in the preparation of a pamphlet which is still in demand as an authoritative treatise on peanut butter manufacture. Effects of time and temperature of roasting on the palatability, appearance, and nutritive properties of the product were determined. Of interest from the standpoint of nutritive value was the finding that even light roasting reduces thiamine content greatly, and that dark roasting may reduce thiamine content to as little as 3% of the original amount. Removal of germ, testa, and other materials from the kernels during roasting and blanching reduces free fatty acids in the peanut butter. An improved method for removal of the testa was developed, as was equipment for the continuous enrichment of peanut butter with vitamin A. Other developments included objective methods for the measurement of color, and specific guidelines for the addition of hydrogenated peanut oil to the butter to prevent oil separation. In studying keeping quality, researchers investigated the tocopherols (natural antioxidants) present in peanuts.

These are some of the earlier contributions by the Southern Division to the betterment of the peanut industry. With solution of some of the more obvious problems, emphasis of the research effort has changed, but in some ways the interest is even greater. Representatives of the peanut industry continue to urge research on the composition of the peanut, with a view to improving the flavor of the processed products. One of the major accomplishments in this direction has been the isolation and identification of the bitter principles of peanuts as sapogenins.

Because of the growing need for protein to meet the world's increased requirements, peanuts, an excellent source of protein of recognized edibility, may well be entering a new era in the nutritional picture. In that event, the body of information contained in the more than 160 technical papers and patents listed here assumes even greater importance than it had in the past.

3901. REMOVAL OF AFLATOXINS FROM OILSEED MEALS BY EXTRACTION WITH AQUEOUS ISOPROPANOL
Rayner, E. T.; and Dollear, F. G.
J. Am. Oil Chemists' Soc. 45, 622-24. (1968)

Aqueous isopropanol was found to be an effective solvent for removal of aflatoxins from contaminated cottonseed and peanut meals. Extraction with six passes of 80% aqueous isopropanol at 60°C. resulted in complete removal of aflatoxins in both meals, as measured by thin-layer chromatography. Under similar extraction conditions, the isopropanol-water azeotrope, 88% isopropanol by weight removed 88% of the total aflatoxins in cottonseed meal, a reduction from 214 ppb to 46 ppb. Lower temperatures were less effective with both solvent systems.

3867. APPEARANCE AND AFLATOXIN CONTENT OF RAW AND DRY ROASTED PEANUT KERNELS
Lee, L. S.; Cucullu, A. F.; and Goldblatt, L. A.
Food Technol. 22, 1131-34. (1968)

One hundred suspect kernels were hand picked from a sample of domestic peanuts that had been graded as sound, mature kernels. Half of each kernel was roasted and assays for aflatoxins were conducted on both the raw and roasted portions of each individual kernel by means of the micro techniques developed by Cucullu et al. (1966). Experiments show that there is an average reduction of about 80% in aflatoxin B_1 and about 60% in aflatoxin B_2 after kernels are roasted for one-half hr. at 150°C. In most cases the roasted half of each kernel containing aflatoxins, although not deeply colored, was darker than the roasted controls. However, many of the raw halves appeared almost identical to normal peanuts. Generally, when the level of toxins was high in the raw kernels, some toxins were detected in the roasted portions. When the levels were low in the raw half, toxins were generally not detectable after roasting.

3803. EFFECT OF ENVIRONMENT ON AFLATOXIN PRODUCTION IN FRESHLY DUG PEANUTS
Diener, U. L.; and Davis, N. D.
Trop. Sci. 10, 22-28. (1968)

Freshly dug Early Runner and Florigiant peanuts were surface disinfected, inoculated with *Aspergillus flavus* and incubated for three weeks in environmental chambers at temperatures of 10 to 45°C. ± 1/2° and relative humidities (R.H.) of 70-98± 1%. Peanuts were sampled after seven and 21 days' incubation, and determinations made of kernel moisture, aflatoxin, and free fatty acid content. In 1965 at 30°C, aflatoxin formed in Early Runner kernels at 92 and 99% R.H., whereas in Florigiant kernels it formed at 87-99% R.H. At 99% R.H. aflatoxin developed at 20-40°C in both varieties, but no aflatoxin was formed at 15 and 45°C. In 1966 at 30°C, aflatoxin formed in Early Runner kernels at R.H. as low as 85%, whereas its low in Florigiant was 87% R.H. At 99% R.H. aflatoxin was produced at 20-35°C in both varieties with small amounts occurring at 40°C in Early Runner and at 15°C in Florigiant. Growth of *A. flavus* was generally correlated with aflatoxin production except at high temperatures of 40-45°C. Free fatty acid formation was generally correlated with the growth of *A. flavus*, but not with aflatoxin production.

3801. INFLUENCIA DEL TRATAMIENTO TERMICO SOBRE LA CALIDAD DE LA PROTEINA DEL CACAHUETE. II. ACCION PROTECTORA DE LA HUMEDAD Y DE LA GRASA Y EFECTO DE LA GLUCOSA Y SACAROSA. (INFLUENCE OF THERMAL TREATMENT ON THE PROTEIN QUALITY OF PEANUTS. II. PROTECTIVE ACTION OF THE HUMIDITY AND OF THE FAT AND EFFECT OF THE GLUCOSE AND SUCROSE) [PL-480 GRANT]
Varela, G.; Moreiras-Varela, O.; Vidal, C.; Murillo, A; and Luque, J. A. (University of Granada, Granada, Spain)
An. Bromatol. 19, 465-83. (1967)

A study was made of the influence of moisture on the nutritive quality of the protein of peanuts during toasting. For this, samples were prepared with three types of peanuts: 1) normal moisture; 2) dried in a vacuum at 50°C. Both were toasted in a laboratory toaster at 180°C. for 25 minutes. The third type of peanut employed was the same as the first, toasted under the same time and temperature conditions, but with the toaster saturated with steam. The nutritive quality of the three proteins toasted were tested by means of the techniques of Mitchell and of Cremer, and by that of Carpenter of available lysine. The results appear to indicate that the moisture of the grain protects against damage to the protein caused by toasting and that damage is much less when the toaster is saturated with steam. To test the influence of fat, both defatted and undefatted peanuts were used. The presence of fat protects the protein from thermal attack. As the action of reducing sugars is known, it was also interesting for us to test the influence of sucrose. The nutritive value of a carbohydrate-free protein of peanuts was determined, as was a mixture of it with sucrose at 4.5%. Both were toasted at different temperatures. The results indicate that the presence of sucrose causes greater damage to the protein during toasting, but that this effect only appears at the highest temperature tested.

3800. INFLUENCIA DEL TRATAMIENTO TERMICO SOBRE LA CALIDAD DE LA PROTEINA DEL CACAHUETE. I. EFECTO DEL TIEMPO Y TEMPERATURA DEL PROCESO Y DEL NIVEL GRASO. (INFLUENCE OF THERMAL TREATMENT ON THE PROTEIN QUALITY OF PEANUTS. I. EFFECT OF TIME AND TEMPERATURE OF THE PROCESS AND FAT LEVEL) [PL-480 GRANT]
Varela, G.; Moreiras-Varela, O.; Vidal, C.; Murillo, A.; and Luque, J. A. (University of Granada, Granada, Spain)
An. Bromatol. 19, 45-66. (1967)

The extraction of fat from peanuts in Soxhlet with sulphuric ether does not significantly affect the quality of the protein, judged both from the point of view of its digestibility and of its biological value, or of its productive protein value. It is possible to use complete undefatted peanuts in the diets of laboratory animals, as the level of fat to which this use gives place does not affect the results obtained in the determination of PPV. When peanuts are subject to toasting for an increasing period, there is first a slight improvement in the quality of the protein, then a marked decrease in quality. When, on maintaining a constant toasting time of 25 minutes, the temperatures are increased, it is noted that from 180°C. there is a marked decrease of NPU. Data obtained by biological methods agreed well with those obtained by chemical methods.

3777. OILSEED MEALS AND FLOURS FOR FOOD USE
Wilcke, H. L.; Martinez, W. H.; and Calvert, F. E.
Soybean Dig. 28 (8): 18, 20. (1968).

The oilseeds from which meal and flours are processed must be selected, sound, clean and wholesome, dehulled, free from molds, or mold toxins, and free of rodent of bird excreta or other contaminants. Oilseed meals and flours for human consumption must meet all the sanitary standards for human foods. They must be of proper particle size, of desireable color and flavor, as free as possible from residual hull fragments, and low in fiber. The heat treatment in processing must be adapted to the desired use of the specific product. Specialized uses require varying characteristics, such as fat-binding, water-dispersibility, and other functional characteristics.

3748. OILSEED TRENDS IN THE SOUTH
Decossas, K. M.; Molaison, L. J.; Kleppinger, A. deB.; and Laporte, V. L.
Cotton Gin and Oil Mill Press 69(7): 8, 11, 14, 18. (1968)

This paper presents a study of changes that have occurred over the past twenty years in oilseed acreages, productions, and values in the southern United States, with projections to 1974. The South produces almost 11 million tons of oilseeds annually, 35% of the U.S. production of the oilseeds listed. In 1966 soybean acreage of almost 10 million in the South exceeded cotton acreage of 8.4 million, and soybean plantings of between 12 and 21 million acres are projected for 1974. The South has consistently cultivated between 85 and 90% of U.S. cotton acreage; more than 92% of U.S. peanut acreage; and an increasing percentage of soybean acreage, reaching 27% in 1966. By 1974, the South is projected to cultivate well over one-third of U.S. soybean acreage. Total obtainable oil equivalent of principal oil crops in the South has steadily increased to more than 2.1 million tons in 1965, whereas total farm value of principal oil crops has trended downward from $2.9 in 1944 (1966 dollars) to $1.9 billion in 1966. Texas and Mississippi combined are projected to produce the equivalent of 1.1 million tons of fats and oils by 1974, an increase of approximately 20% over 1966. Other crops including tung, castorbeans, sesame, flaxseed, safflower, and sunflower seed will continue to supplement total oil supply, and crambe, a newcomer, is expected to have its impact in industrial applications.

3733. EXPERIMENTAL DIETARY HEPATOMA IN RAINBOW TROUT. THE ROLE OF COTTONSEED MEALS AND OTHER DIETS [PL-480 GRANT]
Ghittino, P. (Istituto Zooprofilattico Sperimentale del Piemonte e della Liguria, Torino, Italy); Provana, A.; and Codegone, M. L. (Istituto de Anatomia e Istologia Patologica dell'Universita di Torino, Torino, Italy)
Il Cancro (Torino) 20(6): 24 pages. (1967)

Aflatoxin-free cottonseed meals failed to induce hepatomas in trout continuously exposed for 12-24 months. On the contrary, cottonseed meal-free diets, which contained peanut meal contaminated with aflatoxin (360 ppb of aflatoxin B_1 and trace of B_2), induced hepatomas in 4 months, at water temperature of 15°C, and in 8 months at water temperature of 8°-9°C. Another

diet containing no peanut and no cottonseed meals, which was aflatoxin negative at the manufacturing time but which became positive during the storage, also induced hepatomas in trout. Other diets which contained no aflatoxin did not produce tumors. The role of aflatoxin in the induction of liver tumors in trout is confirmed. On the basis of the present results, it appears that when the aflatoxin level in the diet is relatively low the tumor incidence is not modified but tumor onset is delayed. Histopathological examination of trout liver showed hepatomas only in trout fed diets containing aflatoxin. They were preceded by peculiar "aflatoxicosis or damage-cells" and by "regenerating-cells." Cholangitis was found in all groups of experimental trout. This lesion later appears to evolve in a sclerosis and to be associated with a proliferation of "oval-cells." The authors suggest that many factors may be involved in such inflammatory change, but concerning the cottonseed products, Sterculia foetida oil (containing 55% cyclopropenes), can be considered as the principal cause, producing marked cholangitis in 100% of trout so exposed for 2-3 months.

3734. EFFECT OF ORGANIC SOLVENTS ON THE PROTEINS EXTRACTED FROM PEANUTS
Neucere, N. J.; and Ory, R. L.
J. Agr. Food Chem. 16, 364-65. (1968)

The proteins from peanut meals extracted with three organic solvents (carbon tetrachloride, heptane and acetone) were examined by DEAE-cellulose chromatography. The proteins eluted between 0.0 and 0.17 M NaCl became more insoluble in buffer after extraction with organic solvents. The major protein of the peanut, arachin, changes polarity and is partially dissociated after extraction with acetone. A decrease in the amount of alpha-conarachin in comparison to the native extract was also observed. Structural modifications have induced changes which are reflected in the solubility and ionic properties of the proteins.

3717. AFLATOXIN AND ITS CONTROL
Goldblatt, L. A.
Econ. Botany 22, 51-62. (1968)

Existence of eight different mold metabolites designated aflatoxins is now recognized. All are of known chemical structure and one has been synthesized. Molds in foods and feeds have been a problem for many years but aflatoxin focused attention on the problem of mold toxins and gave a tremendous impetus to research in this area. Aflatoxin is important because of the potential threat it poses. The first and best approach is prevention. Much knowledge as to how to reduce molds sharply is available and this should be applied at all stages of culture, harvest, transportation, and processing. Physical separation, by removal of contaminated seed, has proved feasible in some instances. Effective removal of aflatoxins by extraction, e.g., with polar solvents, has been accomplished. Several chemicals including ammonia, methylamine, sodium hydroxide, hydrogen peroxide and ozone have been used with success to reduce substantially, inactivate or destroy aflatoxins in contaminated oilseed meals but there appears to be some reduction in protein quality during most of the treatments.

3707. RESEARCH AND THE FUTURE OF PEANUTS
Bourdette, V. R.
The Peanut Farmer 4(1): 22-23. (1968)

A brief nontechnical review of Southern Division research on peanut composition, product development, utilization and potential.

3668. FOOD PROTEINS: NEW SOURCES FROM SEEDS
Altschul, A. M.
Science 158, 221-26. (1967)

Adequate protein nutrition is possible at lower cost without the undermining of man's satisfaction with his food. This potential requires the upgrading of the proteins of cereals by supplementation with amino acids and the development of new protein foods from low-cost sources such as the oilseeds; infant malnutrition can be eliminated by such means. The more sophisticated new foods such as protein beverages and textured products are proving acceptable to man and will supplement meager supplies of animal protein.

3575. DETECTION AND ELIMINATION OF AFLATOXIN
Goldblatt, L. A.
Trout Hepatoma Res. Conf., 3rd, Portland, Ore., 1965, U. S. Fish and Wildlife Serv. Res. Rept. 70 (1967). (Papers Ed. by J. E. Halver and I. A. Mitchell.)

Two main groups of test methods proposed for detection or determination of aflatoxin are discussed. One is biological, and the other is chemical. The biological test methods include use of ducklings, chick embryos, microorganisms, enzymes, and cell mitosis. Chemical tests are based on quantitative extractions of aflatoxin by means of a solvent, partial purification to remove interfering components, separation of individual aflatoxin components by thin-layer chromatography, and finally quantification by evaluation of intensity of fluorescence when illuminated with ultraviolet radiation.

Some approaches to elimination of aflatoxin are discussed. Perhaps the best is prevention. Mechanical damage should be avoided during harvesting and handling; moisture, temperature, and insect infestation should be controlled during storage. Mechanical removal of contaminated kernels or seeds may be effective. Alternatively, removal of aflatoxin with selective solvents may be effective. Destruction of aflatoxin with various chemical reagents is being investigated. Such treatments to be effective must also be feasible from other standpoints such as economy of operation and maintenance of nutritive quality.

3466. RELATIONSHIP OF SOIL TREATMENT AND METHOD OF DRYING TO QUALITY OF PEANUTS AND PEANUT BUTTER
Thomas, M. C.; and Lyman, C. M.
Proc. Fourth Natl. Peanut Res. Conf. (Tifton, Ga., July 14-15, 1966), 51-56. (1966)

Peanuts from four soil treatments dried by three methods were compared in organoleptic tests. Organoleptic tests indicated that peanuts grown under

irrigated conditions were of better quality than those grown without irrigation. Treatment of the soil at time of planting did not significantly affect the quality of the peanuts. Elevated temperature to speed the drying process reduced the quality of the peanuts and peanut products. Organoleptic tests showed that mature peanuts are of superior quality to immature and undeveloped peanuts.

3459. CAROTENOID PIGMENTS OF PEANUT OIL
Pattee, H. E. (Market Quality Res. Div., ARS); and
Purcell, A. E. (SU)
J. Am. Oil Chemists' Soc. 44, 328-30. (1967)

A method for determination of carotenoid pigments in peanut oil is described. The major carotenoid pigments found in peanut oil were beta-carotene and lutein. A sample of oil from immature peanuts contained 60 μg of beta-carotene and 138 μg of lutein per liter of oil. The total carotenoid concentration in oil from mature peanuts appears to be less than 1 μg per liter of oil.

3456. AFLATOXIN CONTAMINATION. ELECTRON MICROSCOPIC EVIDENCE OF MOLD PENETRATION
Lee, L. S.; Yatsu, L. Y.; and Goldblatt, L. A.
J. Am. Oil Chemists' Soc. 44, 331-32. (1967)

Electron micrographs of subsections of peanuts contaminated with aflatoxins indicate the presence of mycelia well within the kernel. The toxins are then elaborated in the various layers of the kernel rather than diffusing from the surface. Consequently, a surface wash would not remove all of the toxins from contaminated kernels.

3453. COLORIMETRIC MEASUREMENT OF DRIED FOOD WAFERS--REPRODUCIBLE AND RAPID
Berardi, L. C.; Martinez, W. H.; Boudreaux, G. J.; and Frampton, V.L.
Food Prod. Develop. 1(2): 42, 45. (1967)

A brief description of the procedure evolved for preparing dry food wafers of smooth, uniform surfaces for color measurement is presented. The rapid method involves pressing the dry food sample between Teflon disks in a die with the use of low pressing load and vacuum. Color of the food wafer surface is measured by its reflectance spectrum. The spectrum of a wafer from a homogeneous food sample is highly reproducible both for a single wafer in different positions and among wafers from the same food samples. The first publication concerning this procedure appeared in Food Technology 20: 120-22 (1966).

3444. ISOLATION AND CHARACTERIZATION OF PEANUT SPHEROSOMES
Jacks, T. J.; Yatsu, L. Y.; and Altschul, A. M.
Plant Physiol. 42: 585-97. (1967)

Spherosomes of cotyledons of germinating peanuts (*Arachis hypogaea* L.) were examined by electron microscopy and found to be particles about 1.0 to 2.0 μ in diameter bounded by a limiting membrane. Isolated spherosomes

appear similar to spherosomes _in situ_. The isolated spherosomes are composed of 98.1% total lipids, 0.77% phospholipid, and 1.27% protein by dry weight. The amounts of protein and phospholipid associated with the isolated spherosomes are sufficient to account for limiting membranes. Spherosomes amply account for the lipid in a peanut cotyledon. The activity of lipase and fatty acyl-coenzyme A synthetase is not associated with the isolated spherosomes. This suggests that peanut spherosomes are principal sites of lipid storage but not of lipid degradation.

3433. LIMITING TEMPERATURE AND RELATIVE HUMIDITY FOR GROWTH AND PRODUCTION OF AFLATOXIN AND FREE FATTY ACIDS BY _ASPERGILLUS FLAVUS_ IN STERILE PEANUTS
Diener, U. L.; and Davis, N. D.
J. Am. Oil Chemists' Soc. 44: 259-63. (1967)

Sound mature kernels, broken mature kernels, immature kernels, and unshelled Early Runner peanuts were heat-treated in controlled environment cabinets and inoculated with spores of _Aspergillus flavus_. Treatments were incubated at 97-99% relative humidity at temperatures ranging from 5 to 55° C. and also at 30° C. with relative humidities ranging from 55 to 99%. Samples were removed after 7 and 21 days and assayed for aflatoxin, free fatty acids, and peanut kernel moisture. The lower limit of relative humidity for aflatoxin production by _A. flavus_ was 85 ± 1% relative humidity for 21 days at 30° C. The lowest temperature for visible growth and production of appreciable amounts of aflatoxin by the fungus was 13 ± 1° C. for 21 days at 97-99% relative humidity. Damaged kernels, however, developed some aflatoxin in 21 days at 12° C. The maximum temperature for aflatoxin production was 41.5 ± 1.5° C. for 21 days at 97-99% relative humidity. Fungus growth and sporulation at 43° C. were equal to that at 40° C., but no aflatoxin was produced. Moisture content of immature kernels was higher at equilibrium with the same relative humidity than the moisture content of sound mature kernels, damaged kernels, or kernels from unshelled peanuts. There appeared to be no proportional quantitative correlation between synthesis of aflatoxin and production of free fatty acids in nonliving peanuts, but no aflatoxin was produced without a simultaneous increase in free fatty acids.

3410. PREFACE: WORLD PROTEIN RESOURCES
Altschul, A. M.
Advances in Chem. Ser. No. 57 (1966)

This is the brief introduction by Dr. Altschul at the opening of a symposium on the subject. He outlines the problem in terms of effects of protein deficiencies on human beings, the expected needs, and mentions some solutions which have been suggested.

3395. AFLATOXIN TOXICITY IN SWINE
Hintz, H. F.; Booth, A. N.; Cucullu, A. F.; Gardner, H. K.; and Heitman, H.
Soc. Exptl. Biol. Med. Proc. 124: 266-68. (1967)

Two trials were conducted with 108 pigs, 12-14 weeks old, to study the effects of feeding various levels of aflatoxin. Under the conditions of these experiments, rations containing up to 450 ppb aflatoxin B_1 did not

significantly affect weight gains or feed conversion of growing-finishing pigs. Rations containing 615 ppb aflatoxin B_1 slightly decreased weight gains, and rations containing 810 ppb aflatoxin B_1 greatly decreased weight gains and appeared to decrease feed conversion. One of the 10 pigs fed the 810 ppb aflatoxin ration died, and severe liver degeneration was observed.

3379. MAJOR SEED PROTEINS AND THE CONCEPT OF ALEURINS
Dechary, J. M.; and Altschul, A. M.
Advances in Chem. Ser. No. 57, "World Protein Resources," 148-58. (1966)

Aleurone grains are subcellular particles of seeds which contain the major proteins. "Aleurins" has been suggested as a name to distinguish proteins in aleurone grains from cytoplasmic proteins. Solubility properties of the major seed proteins are described, and the solubility classification system is discussed. The aleurins of wheat and the globulins of soybeans, peanuts, peas, and hempseed are examined with respect to particle size and association-dissociation properties.

3378. AFLATOXIN PRODUCTION BY ISOLATES OF *ASPERGILLUS FLAVUS*
Diener, U. L.; and Davis, N. D.
Phytopathology 56: 1390-93. (1966)

Aspergillus flavus and other fungi were isolated from peanuts, corn, feed, and other sources. Also, isolates of *A. flavus* from peanuts, cereals, soybeans, and other crops were obtained from other investigators. Isolates were screened for aflatoxin production on peanuts and in a nutrient solution. About 80% of the *A. flavus* isolates produced aflatoxin to some degree. Ninety percent of the isolates (designated by the authors as strain 1) produced primarily aflatoxin B_1, whereas about 10% (strain 2) produced both aflatoxins B_1 and G_1. Relation of time and temperature to toxin production by *A. flavus* was studied in flasks of inoculated peanuts and nutrient solution at temperatures of 20, 25, 30, 35, and 40° C. Aflatoxin assays were made at two-day intervals. Optimal temperature for aflatoxin B_1 production by strain 1 on peanuts and in nutrient solution was 25° C. for an incubation period of seven to nine days. Optimal temperature range for aflatoxin production by strain 2, which produced both aflatoxins B_1 and G_1 on both media, was 25 to 30° C. Aflatoxin levels were high throughout the 7- to 21-day incubation period. The proportion of aflatoxin B_1 to G_1 varied with the temperature.

3361. OBJECTIVE FLUOROMETRIC MEASUREMENT OF AFLATOXIN ON TLC PLATES
Pons, W. A., Jr.; Robertson, J. A.; and Goldblatt, L. A.
J. Am. Oil Chemists' Soc. 43: 665-69. (1966)

The solid state fluorescence of aflatoxins separated on silica gel-coated TLC plates was measured on a densitometer equipped for such measurements. There was a linear relationship between peak areas and concentration over a range of at least 2 to 105 X 10^{-4} µg of aflatoxins per spot. Response of the individual aflatoxins was in the descending order of B_2, G_2, B_1, G_1. Aflatoxins can be measured with a precision of ± 2 to 4%.

3359. DEVELOPMENT AND POTENTIAL OF PARTIALLY DEFATTED PEANUTS
Vix, H. L. E.; Spadaro, J. J.; Pominski, J.; and Pearce, H. M.
Peanut J. Nut World 46(3): 10, 11; 46(4): 10, 11, 18; and 46(6): 10, 11. (1967)

Two important reasons for projecting a substantial growth in the peanut industry are: (1) The needs of rapidly increasing world population for vegetable protein foods such as peanuts, (2) The increased use of convenience foods, nutritious confections, and snack items in which peanuts find many outlets. The recent development of the Southern Division's process to produce partially defatted peanuts offers a great potential for aiding in the utilization of peanuts in a variety of tasty and nutritious foods and confections. The process consists essentially of three simple effective mechanical operations: (1) pressing; (2) reconstitution; and (3) drying and roasting. The process is described in detail, and effects of processing variables given. Some potential uses of pressed peanuts are for addition to soups, gravies, and foods to increase their protein content. The process for producing defatted peanuts offers the possibility of adding to peanuts many ingredients, spices, flavoring, and coloring.

3351. PARTIALLY DEFATTED NUT MEATS AND PROCESS
Vix, H. L. E.; Spadaro, J. J.; and Pominski, J.
U. S. Pat. No. 3,294,549, December 27, 1966

A process for producing partially defatted nut meats is described. The process removes high calorie oil from nut meats by mechanical pressing. The pressed, distorted kernels are subsequently reconstituted to their general original size and appearance by expanding them with water. The reconstituted nut meats are not physically damaged by the process, have a high protein content, and after drying, may be roasted and flavored to produce products with a wide variety of food uses.

3320. SOME APPROACHES TO THE ELIMINATION OF AFLATOXIN FROM PROTEIN CONCENTRATES
Goldblatt, L. A.
Advan. Chem. Ser. 57, "World Protein Resources" 216-27. (1966)

Three approaches to elimination of aflatoxin from protein concentrates are prevention, removal, and inactivation. The first and perhaps best approach is prevention. Mechanical damage should be avoided during harvesting and handling; and moisture, temperature, and infestation with insects should be controlled during storage. Reduction of moisture seems to be the most important single factor in control. The second approach is removal. Mechanically removing the contaminated kernels or seeds themselves may be effective. Alternatively, removing aflatoxin by use of selective solvents presents good potential. Polar solvents, such as aqueous acetone or acetone-hexane-water mixture, can be used to remove aflatoxin from oilseeds during processing to oil and meal or from the finished protein concentrates. The third possibility is inactivation of aflatoxin, but this must be accomplished without destroying nutritive value or leaving toxic residues. Exposure to chlorine gas at room temperature or to moist heat at 120° C. appears to destroy toxicity due to aflatoxin. Treatment with gaseous reagents such as ammonia, or with reagents added during processing, may offer a practical means of detoxification.

3313. INACTIVATION AND REMOVAL OF AFLATOXIN
Dollear, F. G.; and Gardner, H. K., Jr.
Proc. Fourth Natl. Peanut Res. Conf.
(Tifton, Ga., July 14-15, 1966), 72-81. (1966)

Progress is reported on approaches to reduction of aflatoxin in peanut and cottonseed products through: (a) physical means of separation, such as segregation on the basis of density and ballistic characteristics of the seed; (b) inactivation or destruction of aflatoxin through the combined effects of temperature, time, moisture, and pressure as well as with chemical treatments; and (c) removal by use of solvent systems in conventional extraction equipment. Promising results have been achieved by the treatment of peanut and cottonseed meals with certain chemicals such as alkalies. Practical methods are sought for deactivation, destruction, and/or removal of aflatoxin which are suitable for use in all types of extraction processes.

3304. INFLUENCE OF PEANUT EXTRACT ON BLEEDING TIME
Frampton, V. L.; Lee, L. S.; Morris, N. J.; and Boudreaux, H. B.
Thromb. Diah. Haemorrhag. 16: 265-76. (1966)

The bleeding time of transected arterioles in the cheek pouch of hamsters ingesting an alcohol extract of defatted peanuts was shortened to about 3/4 that of untreated control animals. Solvent separation and chromatographic methods were used to produce a concentrate representing 0.0025% of the original peanut kernels. The concentrate shortened bleeding time, caused vasoconstriction of transected arterioles after hemostasis, and induced strong contraction of isolated duodenum preparations. The contraction response of duodenum was used as a guide for separation methods. The activity on duodenum was high at concentrations of 10^{-7} g/ml of Tyrode's solution. Preliminary determinations indicate that the active factor might be a lactone but impurities in the best concentrates preclude its positive identification. It is soluble in water, sparingly soluble in ethanol and methanol, very slightly soluble in boiling acetone, insoluble in butanol, chloroform, diethyl ether, 2,2-dimethoxypropane, pyridine, and petroleum ether. A possible role in hemostasis is discussed.

3281. RAPID REPRODUCIBLE PROCEDURE FOR WAFERS OF DRIED FOODS, ESPECIALLY THOSE OF HIGH FATTY CONTENTS: A TOOL FOR COLORIMETRY
Berardi, L. C.; Martinez, W. H.; Boudreaux, G. J.; and Frampton, V. L.
Food Technol. 20: 120-22. (1966)

A method is described for rapid reproducible manufacture from dried foods of wafers possessing uniform smooth surfaces. The method involves distribution of the dry food sample between thin disks of Teflon in a die. After the die and its contents are evacuated for a short specified time, they are pressed quickly with a relatively low pressing load to form wafers which can be used in reflectance measurements. Wafers of the same food sample yielded nearly identical reflectance spectra. A high degree of reproducibility as measured by reflectance spectra was also obtained with wafers prepared by different operators with different presses. The method was found satisfactory for preparing wafers of dry foods of high fatty content, such as lyophilized egg yolks and lyophilized peanut butter, as well as those of intermediate or low fatty contents.

3256. PRODUCTION OF AFLATOXINS B_1 AND G_1 BY ASPERGILLUS FLAVUS IN A SEMISYNTHETIC MEDIUM
Davis, N. D.; Diener, U. L.; and Eldridge, D. W.
Appl. Microbiol. 14: 378-80. (1966)

Isolates of *Aspergillus flavus* produced 0.2 to 63 mg of aflatoxins B_1 and G_1 per 100 ml in a nutrient solution consisting of 20% sucrose and 2% yeast extract. Various factors influencing the fermentation were studied. The maximal amount of toxin was produced by ATCC culture 15548 in one-liter flasks containing 100 ml of medium incubated as stationary cultures for 6 days at 25° C.

3214. RECENT DEVELOPMENTS IN OILSEED RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION
Kopacz, B. M.; Hoffpauir, C. L.; and Dollear, F. G.
Cotton Gin & Oil Mill Press 67(15): 7-8, 25-29. (1966)

A technical review of oilseeds research at the Southern Utilization Research and Development Division is presented covering a 2-1/2 year period. A total of 87 references, with titles, is included. Commodities are cottonseed, peanuts, and tung in the areas of oilseed and oil processing research, product development, seed protein, and related research, research on oilseed mold toxins, cyclopropenoids in cottonseed oil, and exploratory research. Reference is also made to reviews of oilseed research published in the period covered.

3203. DETERMINATION OF AFLATOXINS IN AGRICULTURAL PRODUCTS: USE OF AQUEOUS ACETONE FOR EXTRACTION
Pons, W. A., Jr.; Cucullu, A. F.; Lee, L. S.; Robertson, J. A.; Franz, A. O.; and Goldblatt, L. A.
J. Assoc. Offic. Agr. Chemists 49: 554-62. (1966)

An analytical procedure originally developed for the determination of aflatoxins in cottonseed products has been modified for application to many other agricultural materials. Aflatoxins are rapidly extracted free of lipid contamination with 70% acetone. Many interfering pigments are removed from the crude extract by precipitation as insoluble lead derivatives, transfer of aflatoxins into chloroform, and further purification of the chloroform extract with silica gel. The procedure was compared with four recently proposed methods for the analysis of peanut products. This technique is capable of detecting as little as 0.3 ppb of aflatoxin B_1 in peanuts and peanut butters. Adequate recovery of added aflatoxins was obtained when this method was applied to numerous different agricultural products.

3119. DETERMINATION OF AFLATOXINS IN INDIVIDUAL PEANUTS AND PEANUT SECTIONS
Cucullu, A. F.; Lee, L. S.; Mayne, R. Y.; and Goldblatt, L. A.
J. Am. Oil Chemists' Soc. 43: 89-92. (1966)

Subsamples of a given lot of peanuts may vary greatly in aflatoxin content due to extreme variability in the degree of contamination of individual kernels. A micro method, adapted from the aqueous acetone procedure recently proposed by Pons and Goldblatt for the determination of aflatoxins in cottonseed products, was developed to permit accurate determination of

aflatoxins in individual kernels and kernel sections. This procedure makes possible the mapping of the topographic distribution of aflatoxins within single kernels and indicated that the toxins are not uniformly distributed within contaminated kernels, even when the kernel contains a high level of aflatoxins. Although wrinkling or discoloration sometimes indicated that a kernel was contaminated, this type of physical damage was not found to be a reliable indication of aflatoxin content. Also it was noted that a few apparently sound and mature kernels contained high levels of aflatoxins.

3115. AFLATOXIN
Goldblatt, L. A.
Assoc. Food Drug Officials U. S. Quart. Bull. 29: 153-69. (1965)

Molds in feeds have been a problem for a great many years. Developments in 1960 relative to the "Turkey X" disease in poultry dramatized and focused attention on the problem of mold toxins, especially aflatoxin, and gave impetus to mold toxin research. The Southern Regional Research Laboratory is conducting one part of a comprehensive Department program of research on mycotoxins that embraces many agricultural commodities. Its broad objectives are: (1) to develop analytical methodology; (2) to determine the effect of graded levels of aflatoxin on various experimental animals, including farm animals; (3) to find practical methods for preventing or at least minimizing mold growth in our commodities; and (4) to develop processes for removing or destroying toxins in those lots of our commodities that may have been contaminated with toxin-producing molds. Some results of this work are presented.

3065. THE STATUS OF THE PROBLEM OF HEMOSTASIS AND PEANUTS
Boudreaux, H. B.; and Frampton, V. L.
Proc. Intern. Soc. Rehabilitation Disabled, 9th World Congr., Copenhagen, Denmark, 1963, 281-84. (Pub. 1965)

Evidence is presented indicating that some bleeding episodes in hemophilia can be suppressed or avoided through oral consumption of peanut products. The hemostatic mechanism is evaluated in terms of initial hemostatic events, and the role of a peanut substance in hemostasis is discussed, providing a hypothesis for the action: a substance in peanuts causes the formation of a hemostatic platelet plug which is more efficient than the defective platelet plug of hemophilia. The hemostatic platelet plug is formed independently of the plasma clotting sequence, and the peanut factor has no measurable influence on blood coagulation. Purification procedures searching for the peanut substance include solvent separation and chromatographic partition of a substance absorbed by platelets and released during viscous metamorphosis.

2993. MECHANICALLY SQUEEZE OUT 80% OF OIL WITHOUT DISTORTING SHAPE OF LOW-CALORIE PEANUTS
Vix, H. L. E.; Spadaro, J. J.; Pominski, J.; and Pearce, H. M., Jr.
Food Process. Marketing 26(9): 80-83. (1965)

Peanuts contain 45 to 55% oil, and this oil fraction contains about 80% of the calories in peanuts. A process has been developed at the Southern Utilization Research and Development Division whereby up to 80% of the oil

can be mechanically removed from peanuts. Either raw or blanched peanuts are hydraulically pressed to remove the desired amount of oil. The pressed, misshapened peanuts are heated in hot water to expand or "reconstitute" the peanuts to their original size and shape. The expanded peanuts are then dried and either dry- or oil-roasted. Moisture content of peanuts prior to pressing has an important effect on both the amount of oil removed and on peanut breakage.

2976. PEANUT FLOUR CONSTITUENTS. CYCLIC IMINO ACID DERIVATIVE FROM PEANUT FLOUR
Lee, L. S.; Morris, N. J.; and Frampton, V. L.
Agr. Food Chem. 13: 309-11. (1965)

An imino acid derivative, melting at 236-38° C., not reported previously as a constituent of an edible product, was isolated from peanut flour (0.02% yield) in the course of a chromatographic investigation of the nonprotein fraction. Its identity as N-methylhydroxyproline was proved by elemental analysis, molecular weight determination, and comparison of the infrared spectrum of the compound with that of N-methylhydroxyproline synthesized in the laboratory. The structure of the synthetic product was confirmed by elemental and functional group analysis as well as by nuclear magnetic resonance.

2968. REMOVAL OF AFLATOXIN FROM PEANUT PRODUCTS WITH ACETONE-HEXANE-WATER SOLVENT
Goldblatt, L. A.
Intern. Symp., "Mycotoxins in Foodstuffs," Cambridge, Mass., 1964, 261-63. (Publ. 1965). The M.I.T. Press, G. N. Wogan, Ed.

Application of a solvent mixture composed of acetone, hexane, and water to solution of the aflatoxin problem is discussed. Four possible uses of this solvent mixture are described: (1) extraction solvent for analysis, (2) removal of aflatoxin from peanut meal and other oilseed meals, (3) conversion of peanuts to aflatoxin-free oil and meal, and (4) removal of aflatoxin from whole peanuts. The value of this solvent mixture for analysis has been established and its potential utility in commercial processing is indicated.

2930. ASSAY OF AFLATOXIN IN PEANUTS AND PEANUT PRODUCTS USING ACETONE-HEXANE-WATER FOR EXTRACTION
Robertson, J. A., Jr.; Lee, L. S.; Cucullu, A. F.; and Goldblatt, L.A.
J. Am. Oil Chemists' Soc. 42, 467-71. (1965)

A quantitative method is described for the assay of aflatoxin in peanut products. The procedure involves extraction of aflatoxin from the sample with a homogeneous acetone-hexane-water solvent mixture, followed by purification of the extract by phasic extraction of the aflatoxin with aqueous sodium chloride and then with chloroform. The purified chloroform extract is analyzed by thin-layer chromatography by comparison of the intensity of fluorescence of any aflatoxin with the intensity of a known standard. The aflatoxin analyses of peanuts were found to be very variable due to sampling. This variability has been greatly reduced by finely grinding and thoroughly mixing 2 kg of the sample before removal of an aliquot for assay. The method is sensitive to approximately 2 parts per billion.

2853. INTRACELLULAR DISTRIBUTION OF SEED PROTEINS. IMPLICATIONS FOR FOOD SCIENCE
Altschul, A. M.; Dechary, J. M.; and Evans, W. J.
Intern. Congr. Food Sci. & Technol., Proc., 1st, London, 1962. (Publ. 1964)

Seeds are the major source of protein for man and animals. In the search for increased protein supplies for the present and for future world populations, increased attention will be given to more efficient use of proteins from oilseeds and this will require a more sophisticated handling of the raw materials to put them in the best utilizable form. The proteins of peanuts were chosen for detailed study by DEAE cellulose chromatography and zone electrophoresis, and by controlled rupture of the cells in such ways as to leave intact subcellular fractions containing the proteins. Approximately 75 percent of the proteins in the peanut cotyledon exists in particles which are protected from disruption by high molecular weight materials such as Carbowax. These are the less soluble proteins and these generally have a lower nutritive value than the smaller proportion of proteins which are apparently free in the cytoplasm. Food science must take into account this segregation of the proteins and other seed contents in developing processes which will allow maximum utilization of the seed proteins and permit the minimum deleterious changes to take place during processing. The changes in processing may be followed by methods which depend on estimating the integrity of the cellular particles. Recognition of this compartmentalization adds another dimension to the opportunities of food science.

2840. REVIEW OF RESEARCH ON AFLATOXIN AT THE SOUTHERN REGIONAL RESEARCH LABORATORY
Goldblatt, L. A.
Proc. Natl. Peanut Res. Conf. 3rd, 128-33. (1964)

Current and planned research on aflatoxin at the Southern Regional Research Laboratory as related to peanuts and cottonseed is discussed. Reference is made to extraction of cottonseed meals in study of the trout hepatoma problem, preparation of peanut products for use in long-term rat feeding trials, development of analytical methodology, potential utility of acetone-hexane-water solvent mixtures to prepare aflatoxin-free products, surveys of prevalence of aflatoxin in domestic stocks of peanuts, and investigation of other fungal flora of cottonseed and peanuts to determine if they produce toxins harmful to animals. Reference is made to cooperation with the Pharmacology Laboratory at WU and to research on aflatoxin by contract and with PL 480 funds.

2814. RIBONUCLEOPROTEIN PARTICLES FROM STORAGE TISSUE OF MATURE SEEDS
Phillips, Marshall
Biochim. Biophys. Acta 91, 350-51. (1964)

A method is presented for the isolation of ribosomes from the storage portion of mature *Arachis hypogaea* and *Gossypium hirsutum* seeds. The dry seeds were homogenized in cottonseed oil and separated into subcellular components by differential centrifugation. The ribosomes were isolated from the RNA-rich

fraction. Characterization of the particles as to UV spectra, RNA-protein content, and sedimentation coefficients revealed them to be similar to ribosomes from other sources.

2808. LIPOLYSIS AND THE FREE FATTY ACID POOL IN SEEDLINGS
St. Angelo, A.J.; and Altschul, A. M.
Plant Physiol. 39: 880-83. (1964)

Lipolytic activity at pH 4-5 was observed in the macerates of tissues from castor beans, peanuts, and cottonseeds germinated 4, 7, and 3 days, respectively. p-Chloromercuribenzoate inhibited lipolysis in the castor seedlings. The peanut exhibited two maxima of lipolytic activity as germination progressed: 7 and 13 days. The latter was attributed to molds. When lipolysis is minimized during maceration, the long-chain free fatty acid content in the different species tested was less than 0.35 μmoles per seedling. This value began to increase in the peanut as that seedling germinated past the 8th day. It is concluded that the free fatty acid pool in germinating seeds is very small. In those instances where substantial amounts have been observed, this could be due either to conditions of maceration or to mold growth.

2769. SEED PROTEINS
Altschul, A. M.
Proc. Symp. Foods: Proteins and Their Reactions, Corvallis, Oregon 1963, Chap. 13, 295-313. (Publ. 1964)

The major globulins of seeds can be investigated by chromatography on DEAE cellulose and by gel electrophoresis, particularly on polyacrylamide gel, as well as by sedimentation. Purified protein fractions undergo association-dissociation reactions with change in pH and ionic strength, can be dissociated by urea and other reagents into fragments of molecular weight below 20,000, and show relatively less organization and masking of reactive groups compared to other globular proteins. Most major globulins are found in subcellular particles associated with storage carbohydrate, fat, and phosphorus. The location of these proteins within the cell and their characteristic molecular properties influence their reactions during processing of seeds and their behavior when isolated.

2768. A NEW CLASSIFICATION OF SEED PROTEINS: APPLICATION TO THE ALEURINS OF ARACHIS HYPOGAEA
Altschul, A. M., Neucere, N. J.; Woodham, A. A.; and Dechary, J. M.
Nature 203: 501-04. (1964)

An approach to classification of seed proteins is proposed which uses an element of uniqueness in seeds as the basis for categorization, rather than classification by solubility. Since much of the protein contained in seeds exists in so-called aleurone grains, or protein bodies, the proposal is made that those proteins thus contained be named "aleurins." This approach to classification is illustrated by consideration of the soluble proteins of the cotyledon of *Arachis hypogaea*.

2759. SOME COMPONENTS OF THE PEANUT SEED (No reprints available)
Altschul, A. M.
Proc. Natl. Peanut Res. Conf., 2nd, Raleigh, N. C., 1962: 101-07. (Publ. 1964)

This paper discusses the problem of understanding seed proteins from the biochemical approach, i.e., understanding the meaning of these proteins within the context in which they are found, rather than from the food technology approach, which determines composition and how it can be modified to suit man's requirements. Examples of the outcome and possible consequences of information obtained through biochemistry are cited.

2673. PEANUTS AND HEMOSTASIS IN HEMOPHILIA
Frampton, V. L.; and Boudreaux, H. B.
Econ. Botany 17: 312-16. (1963)

Ingestion of peanuts, peanut flour, or an ethyl alcohol extract of defatted peanuts induces hemostasis in hemophilia. The ethyl alcohol extract contains a myotonic factor which, on ingestion by hamsters, seems to be incorporated into hamster blood platelets and to be liberated at the site of capillary injury to induce strong vasoconstriction in cheek pouch capillaries of adrenalectomized (demedullated) animals. The myotonic factor is active against excised hamster duodenum in Tyrodes solution in concentrations of less than 0.1 ppm.

2661. PILOT PLANT PREPARATION OF DEFATTED PEANUTS
Pominski, J.; Patton, E. L.; and Spadaro, J. J.
J. Am. Oil Chemists' Soc. 41: 66-68. (1964)

Interest in defatted peanuts is due to several factors: lower calorie value; possible increase in shelf-life by minimizing oil rancidity; possible use by hemophiliacs to control bleeding; and development of a new product to increase utilization of peanuts. On the basis of previous laboratory work, pilot-plant runs were conducted to prepare large amounts of materials for taste and appearance evaluation, to obtain pilot-plant processing data for cost calculations, to investigate practical methods for desolventizing extracted peanuts, to develop a method for salting defatted peanuts, and to study packaging. Fully roasted and half-roasted batches of Virginia peanuts were extracted with hexane at room temperature for various periods of time, and oil losses determined. Fully roasted peanuts with 81% of the oil removed had the best appearance, an acceptable taste, and require 120-hr. extraction. Low rates of extraction indicate that large-scale processing would be a batch method. The extracted peanuts were desolventized for various periods of time and temperature in both forced draft and vacuum ovens. Drying at low initial temperature prior to a final high temperature appears to give a better tasting peanut. Desolventizing peanuts in either a forced draft or vacuum oven requires from 9-10 hr. drying time. Defatted, desolventized peanuts were salted either by dipping in saturated salt solution at room temperature, or preferably by dipping in water and sprinkling with salt. The wet peanuts were oven dried. Packaging of defatted peanuts (81% oil removed) in metal cans, in either vacuum or in an atmosphere of nitrogen containing less than 2% oxygen, proved satisfactory even after one-year storage time. In flexible cellophane-type package, defatted peanuts tended to pick up excessive moisture within 30 days.

2646. PEANUTS--FROM THE BALL PARK TO THE RANGE
Lambou, M. G.; Decossas, K. M.; and Vix, H. L. E.
J. Am. Oil Chemists' Soc. 40: (12 News Section) 4, 8, 16, 17, 27, 28, 36, 38, 48, and 50. (1963)

Domestic and world production, utilization and trading in peanuts and its products are discussed, with considerable emphasis on domestic utilization. Also included are results of recent research at the Southern Division and State Agricultural Experiment Stations. The report of work at the Southern Division includes research on physiological properties of constituents in peanuts including one that relaxes muscles, another that causes strong contraction of smooth muscles, saponins that are responsible for the bitter flavor, pinitol, nicotinic acid, and nicotinamide; research on available lysine; new products, specifically de-oiled peanuts, acetylated peanut oil that increases the plasticity of margarine, hydrogenated peanut oil that prevents separation of peanut butter; and morpholides that make good plasticizers for vinyl chloride; and, fundamental research on intracellular distribution of peanut protein via chromatographic separation on DEAE cellulose and zone electrophoresis, and changes in one fraction during germination. Recent research at the State Agricultural Experiment Stations reports on new varieties; hollow hearts because of boron deficiency; increased yields from close-space planting; development of new mechanical diggers, digger-shakers, digger-shaker-windrowers, and shaker-windrowers; control of peanut diseases; and new machines to improve cleaning, grading, sampling, shelling, and kernel splitting.

2573. ISOLATION AND IDENTIFICATION OF PINITOL FROM PEANUT FLOUR
Lee, L. S.; and Morris, N. J.
J. Agr. Food Chem. 11: 321-22. (1963)

Pinitol, a monomethyl ether of D-inositol, has been isolated from peanut flour. Its identity was proved by elemental analysis, molecular weight determination, and comparison of the infrared spectra of the compound and of its derivative, diisopropylidene pinitol, with the infrared spectra of authentic samples of these substances.

2572. A STUDY OF PROTEIN BODIES DURING GERMINATION OF PEANUT (ARACHIS HYPOGAEA) SEED
Bagley, B. W.; Cherry, J. H.; Rollins, M. L.; and Altschul, A. M.
Am. J. Botany 50: 523-32. (1963)

Upon germination of peanut seed (*Arachis hypogaea*) there is an ordered series of events leading to the degradation of storage protein in cotyledonary cells. In resting seed, the protein is stored in large bodies (protein bodies) about 5-10 μ in diameter. As the seeds germinate, the protein bodies swell and develop cavities within. Later these swollen bodies break up into many fragments which are digested and disappear. The major changes in proteins as revealed by microscopy and by protein analysis occur between 4 and 9 days of germination. By 15 days, the parenchyma cells are empty of protein bodies or fragments, but they contain many small starch grains. In a given cell population, there is a wide range of protein-body degradation, the degree of degradation being related to the distance from the nearest vascular bundle. In resting seed, there is a honeycomb-like

structure between and connected to the subcellular particles. After 2 days of germination, this structure is no longer visibly intact.

2571. NUCLEIC ACID MITOCHONDRIA, AND ENZYME CHANGES IN COTYLEDONS OF PEANUT SEEDS DURING GERMINATION
Cherry, J. H.
Plant Physiol. 38: 440-46. (1963)

A study of the nucleic acid content and activities of several enzymes and mitochondria of the peanut cotyledon was made during germination. The following observations were noted: I. During the germination of peanut seed over 60% of the dry weight of the cotyledon and 70% of the protein is depleted. II. RNA content of the cotyledon triples from 0 to 8 days of germination; subsequent germination results in a rapid loss of RNA. Concomitant with the *in vivo* degradation of RNA the ribonuclease activity increases severalfold. III. DNA content of the cotyledon doubles by the tenth day followed by a reduction in content thereafter. IV. Oxidative and phosphorylative activities of isolated mitochondria showed an increase during germination with their peak in activity occurring at about 8 days; subsequent germination resulted in a decline in activity. The P/O ratios with succinate and α-ketoglutarate as substrates declined with seedling age. V. Electron micrographs showed that the cotyledon of resting seed contain few typical mitochondria, but many vesicular membranes. During the first 8 days of germination the mitochondria appear to increase in structure and internal organization. As the germination process proceeds, the mitochondria swell and there is a large degree of disintegration. VI. DPNH cytochrome c reductase, succinic cytochrome c reductase, glucose-6-P dehydrogenase, and isocitritase of homogenates of cotyledonary tissue increased in activity to about the fifth to eighth day of germination, followed by a rapid reduction in activity thereafter. VII. DPNH oxidase and cytochrome oxidase of homogenates showed slight changes with germination, while succinic dehydrogenase and cytochrome oxidase of acetone powders of mitochondria increased in activity with seedling age.

2564. AN ACID-INDUCED TRANSFORMATION OF α-CONARACHIN
Evans, W. J.; Carney, W. B.; and Neucere, N. J.
Nature 198: 1303-04. (1963)

Though for most proteins there is a characteristic pH range of stability to irreversible changes, seed proteins in general are particularly sensitive to mild conditions of acidity. Conarachin was reported to undergo irreversible changes when exposed to pH values below 4. This is a report of the effect of mild acidity on α-conarachin which was separated from the conarachin fraction of peanut proteins by chromatography on DEAE cellulose. α-Conarachin undergoes a rather unusual dimerization under conditions of mild acidity. This is a part of a study of the effect of acid conditions as a means of elucidating some of the structural aspects of seed proteins.

2520. SEED PROTEIN CONFERENCE
Talluto, K. F.
AIBS Bull. (J. Am. Inst. Biol. Sci.) 13(2): 50-51. (1963)

A brief summary of the Seed Protein Conference sponsored by the Southern Utilization Research and Development Division, held January 21-23, 1963, is

given. Topics discussed include: subcellular location of seed proteins; isolation and properties of certain biologically active seed proteins; synthesis of enzymes during germination; recent progress in analysis and purification of proteins; properties of pure seed proteins; and questions on organization and conformation of seed proteins.

2519. NUCLEIC ACID CHANGES IN THE STORAGE TISSUE OF SEEDS DURING GERMINATION
Cherry, J. H.
Biochim. et Biophys. Acta 68: 193-98 (1963)

It was found that during the germination of Arachis hypogaea L. (peanut) seed the RNA content increased to a maximum (2-fold) during the first part of germination (2-6 days) and subsequently decreased, with further germination. This is contrary to previous reports on the depletion of RNA from the storage tissues of corn, bean, and rice seeds. The pattern of RNA metabolism was quite similar for four varieties of mature and immature peanut seed and between the same variety produced in two different locations. The minor differences between varieties might possibly be related to seed size. Reinvestigation of nucleic acid changes in the corn scutellum showed that the RNA content increased 20% the first day of germination, but decreased thereafter. In most cases, the DNA content of peanut cotyledons and corn scutella did not change significantly during germination.

2428. DEFATTED PEANUTS: PRELIMINARY COST STUDY
Molaison, L. J.; Decossas, K. M.; Pominski, J.; and Patton, E. L.
J. Am. Oil Chemists' Soc. 39: 473-76. (1962)

Defatted peanuts are high in protein and low in fat content. A preliminary cost study for defatting Virginia peanuts with hexane in three all-new hypothetical commercial plants indicates operating cost can be as low as 84 cents/lb. of peanuts extracted when packaged in 502x308 tins. Cost in fully depreciated plants is as low as 61.5 cents for a volume of extracted peanuts equivalent to the amount of unextracted peanuts normally packaged in 502x308 tins. Process development shows promise for further reducing these costs, which are based on limited exploratory pilot-plant research.

2352. PEANUT RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION, NEW ORLEANS, LOUISIANA, 1942-1961
Revised by Jones, M. A.
U. S. Dept. Agr., Agr. Res. Service, Sou. Util. Res. and Dev. Div., 46 pp. (1962)

Reports of research on the chemistry and processing of peanuts as conducted by the Southern Utilization Research and Development Division beginning with establishment of the Southern Regional Research Laboratory are listed, with abstracts. Subject and author indexes are included. This publication is periodically brought up-to-date and the latest issue will be sent in response to requests.

2347. COMPOSITION OF SOME SUBCELLULAR FRACTIONS FROM SEEDS OF ARACHIS HYPOGAEA
Dieckert, J. W.; Snowden, J. E., Jr.; Moore, A. T.; Heinzelman, D. C.; and Altschul, A. M.
J. Food Sci. 27: 321-25. (1962)

Five fractions of parenchymatous cells of the cotyledon of the peanut were isolated by homogenization and differential centrifugation from nonaqueous media. These are two protein-rich fractions (one of which appears to be aleurone grains), starch grains, a fines material, and cell wall fragments. In addition, a fraction composed largely of vascular tissue of the cotyledon was isolated. The nitrogen of the cell is concentrated in the two protein-rich fractions, phytin in the aleurone grains, sucrose mostly in the fines fraction and to a lesser extent in the starch granules, and ribonucleic acid in the fines fraction. The proteins in both protein-rich fractions appear to be the same when judged either by chromatography or zone electrophoresis.

2346. SEED PROTEINS AND WORLD FOOD PROBLEMS
Altschul, A. M.
Econ. Botany 16: 2-13. (1962)

The problem of providing adequate protein for an expanding world population is discussed, with particular emphasis on the potential for obtaining added protein for humans from seeds. In order to understand the role plant proteins must play in increasing the protein supply, it is necessary to start with present practice and analyze its benefits and shortcomings. Facets of the problem discussed are the development of new methods, degree of sophistication necessary in processing these seeds, and new knowledge about seed proteins which must be acquired. Examples drawn from the so-called oilseeds illustrate the discussion of these problems.

2292. ZONE ELECTROPHORESIS OF CONARACHIN, α-CONARACHIN AND BOVINE SERUM ALBUMIN ON POLYACRYLAMIDE GEL
Evans, W. J.; Carney, W. B.; Dechary, J. M.; and Altschul, A. M.
Arch. Biochem. Biophys. 96: 233-39. (1962)

Conarachin, a crude fraction of peanut globulins; the major component of this fraction, α-conarachin; and crystalline bovine serum albumin were examined by zone electrophoresis on polyacrylamide gel. This medium made possible the clear demonstration of the complexity of composition of crude fractions of seed proteins. α-Conarachin, which is homogeneous by gradient elution chromatography on DEAE-cellulose, showed several closely related components by zone electrophoresis; crystalline bovine serum albumin showed several components by this procedure. Sedimentation analysis of the peanut globulins confirmed that they are part of an association-dissociation system.

2244. INTRACELLULAR DISTRIBUTION OF SEED PROTEINS
Altschul, A. M.; Snowden, J. E., Jr.; Manchon, D. D., Jr.; and Dechary, J. M.
Arch. Biochem. Biophys. 92, 402-04. (1961)

The total proteins from peanuts (Arachis hypogaea L.) were separated into soluble and particle-bound fractions, with sucrose and Carbowax as the media;

some fractionation of the particle-bound proteins also seems possible by selective disruption of particles. The method of isolation is described. The fractions were examined by chromatography on DEAE cellulose. The total proteins were divided into four groups. The proteins of groups I and II were relatively unchanged in early germination and are water-soluble; those of groups III and IV are globulins, and comprise 75% of the protein. They are the most tightly bound to the adsorbent, show profound changes in early germination, and are particle-bound.

2147. α-CONARACHIN
Dechary, J. M.; Talluto, K. F.; Evans, W. J.; Carney, W. B.; and Altschul, A. M.
Nature 190, 1125-26. (1961)

Chromatography on DEAE cellulose permitted better identification of changes on germination of specific protein fractions of the peanut (Arachis hypogaea). One fraction that changes early on germination was isolated and named α-conarachin. This fraction approaches monodispersity by standards of chromatography and ultracentrifugation. The chromatographic method used is described and patterns given for four arbitrarily-selected protein fractions; arachin (group IV), and conarachin (groups I, II and III).

2192. PRESENT STATUS OF PROTEINS FROM OILSEEDS
Altschul, A. M.
Proc. Intern. Conf. Natl. Acad. Sci. - Natl. Research Council Publ. 843, 517-30. (1961)

Principles and practices involved in obtaining plant protein mixtures of high nutritive value are discussed. Subjects covered are the quantity of oilseeds potentially available for incorporation into mixtures suitable for human foods; problems to be solved in order that these materials can be used effectively in human diets; opportunities already existing for incorporating these materials into high-protein diets; and what can be expected as knowledge and technology advance.

1918. A PEANUT FACTOR FOR HAEMOSTASIS IN HAEMOPHILIA
Boudreaux, H. B.; and Frampton, V. L.
Nature 185, 469-70. (1960)

Oral ingestion of peanut flour or of an alcohol extract of defatted peanut meal equalling one to two pounds of peanuts per day was observed to relieve haemophiliacs from pain and swelling indicative of active haematomata in haemophilia.

1933. SUBCELLULAR DISTRIBUTION OF SUBSTANCES IN SEEDS OF ARACHIS HYPOGAEA
Dieckert, J. W.; and Snowden, J. E., Jr.
Federation Proc. 19, 126. (1960) (Abstract) (Reprints not available)

The quiescent state in seeds is not well understood. One facet of the problem is the biochemical cytology of late maturation, quiescent and early germination stages of the seed. To learn more about this aspect of the problem, a study was made of the intracellular distribution of substances in the cotyledons of peanuts. Several subcellular components were isolated by homogenization and differential centrifugation in nonaqueous media.

The most homogeneous fractions were: aleurone grains, protein bodies, starch grains, cell walls and a reticulum. Nuclei were not obtained pure. Analysis indicated that the aleurone grains are high in protein, phytin, and ash. The protein bodies are high in protein and low in phytin. Starch grains are low in protein and phytin but high in starch. DNA followed nuclei only. The reticulum is high in protein, phosphatides and RNA. The presence of RNA here suggests the presence of important enzyme-forming elements that will become functional during germination. The cell wall fraction showed more nitrogen than expected on the basis of observed contamination by high protein particulates. This suggests that nonparticulate cytoplasmic material remains with the cell wall. These data confirm that a high degree of compartmentation exists in the quiescent cell.

1997. BIOASSAY OF A HEMOSTATIC FACTOR FROM PEANUTS
Boudreaux, H. B.; Boudreaux, R. M.; Brandon, M.; Frampton, V. L.; and Lee, L. S.
Arch. Biochem. Biophys. 89, 276-80. (1960)

Extreme vasoconstriction is induced on the transection of arteries of the cheek pouch of bilaterally adrenolectomized male hamsters that have ingested an absolute alcohol extract of defatted peanuts. This is compared with slight or moderate vasoconstriction observed with control bilaterally adrenalectomized male hamsters. Apparently the vasoconstrictor from peanuts is released from storage in the blood platelets during their viscous metamorphosis in the formation of the platelet plug. The active factor is also myotonic to smooth muscles.

1779. SAPONINS OF THE PEANUT: ISOLATION OF SOME PEANUT SAPOGENINS AND THEIR COMPARISON WITH THE SOYA SAPOGENOLS BY GLASS-PAPER CHROMATOGRAPHY
Dieckert, J. W.; Morris, N. J.; and Mason, A. F.
Arch. Biochem. Biophys. 82, 220-28. (1959)

A column is described that directly scales up glass-paper chromatography. The new column was used to obtain milligram quantities of peanut sapogenins A_1, A_2, C_1, and C_2. The silicic acid, potassium silicate, and the monopotassium phosphate forms of glass paper have been used to compare four peanut sapogenins with the four soya sapogenols A, B, C, and D. The soya sapogenols were resolved on glass paper impregnated with silicic acid. Soya sapogenol B and D could not be separated on glass paper treated with potassium silicate or on glass paper treated with monopotassium phosphate. Peanut sapogenins A_2, C_1, and C_2 are distinct from soya sapogenols A, B, C, and D. Peanut sapogenin A_1 chromatographs like soya sapogenol B on all three forms of glass paper.

1768. HIGHLIGHTS OF PEANUT UTILIZATION RESEARCH AT SURDD
Fisher, C. H.
Peanut J. and Nut World 38(6): 14, 16, 31-33. (1959)

Research in the Southern Division applicable to peanuts is summarized. This includes research projects directed specifically to the study of peanuts, and also research of a more general nature on oilseeds and vegetable oils. In the first group are investigations of the constituents which cause

peanuts to have a bitter flavor, and the effects of curing and processing on peanut constituents, especially with regard to flavor, aroma, and nutritive value. Among the more general research developments which might offer outlets for peanut oil are a domestic fat with properties similar to those of cocoa butter, for use in the confectionery industry; acetoglycerides and polymeric fats, compounds with special properties which can be "tailored" for specific uses, such as coatings, global spreads, and other uses where unusual properties are desirable.

1681. HEAT EFFECTS ON PEANUT PROTEINS. EFFECT OF PROCESSING ON THE EPSILON-AMINO GROUPS OF LYSINE IN PEANUT PROTEINS
Bensabat, L.; Frampton, V. L.; Allen, L. E.; and Hill, R. A.
J. Agr. Food Chem. 6: 773. (1958)

Peanut flour can be analyzed for protein deterioration by following the change in the ε-amino groups of lysine, which was determined colorimetrically as the ε-2,4-dinitrofluorobenzene derivative.

1679. BITTER PRINCIPLES OF THE PEANUT, ISOLATION, GENERAL PROPERTIES, AND DISTRIBUTION IN THE SEED
Dieckert, J. W.; and Morris, N. J.
J. Agr. Food Chem. 6: 930. (1958)

A concentrate of the bitter principles of peanut hearts has been prepared, which possesses the general properties of the saponins. Glass paper chromatography indicates at least four components, each stained reddish purple with concentrated sulfuric acid and altered by acid hydrolysis. Aglycones obtained by acid hydrolysis can be separated into at least six components by chromatography on glass paper treated with monopotassium phosphate. Each gives a reddish purple color with sulfuric acid. The sugar moiety from the hydrolytic cleavage products gives four spots when chromatographed. These spots correspond in R_f value and color to glucose, xylose, rhamnose, and glucuronolactone.

1465. DE-OILING OF PEANUTS TO YIELD A POTENTIALLY USEFUL FOOD PRODUCT
Willich, R. K.; and Feuge, R. O.
Food Tech. 11: 332-36. (1957)

Experiments have shown that oil can be removed from whole peanuts, either raw or roasted, by soaking them in a suitable solvent. The moisture content of the peanuts and the nature of the solvent are among the factors which influence the extraction rate. With commercial hexane at 30° C. about 50% of the oil can be removed in about 50 hours from blanched peanuts having a moisture content of 3%. It is expected that a large-scale extraction would be carried out in storage tanks and the solvent would be changed infrequently. Residual solvent can be removed from the de-oiled peanuts by warming and stripping with air under reduced pressure. The de-oiled peanuts still retain part of their characteristic flavor, though a large part of the flavor is lost. Retaining a portion of the oil in the peanuts improves their flavor. The texture of the de-oiled peanuts is firm, and the crispness appears to be unchanged.

1466. PURPOSE OF CONFERENCE. An Address at a Peanut Research Conference in Atlanta, Ga., February 21-23, 1957
Altschul, A. M.
Proc. Peanut Research Conference 1957, 5-8

Four general objectives of the research conference are stated. The production of peanuts in the United States for 1956 was 783,000 tons, valued to the farmers at $189 million. While in most parts of the world peanuts are important as a source of oil and meal, in this country only 23% are crushed for oil and meal, the remainder are eaten as nuts, or in peanut butter. New uses might be developed to broaden the market; studies on the composition of peanuts, especially in regard to trace materials and nutrients, could be useful in determining food value. Another field of exploration, that of fats in the diet, is of great interest to the peanut industry.

1538. A PHYSICOCHEMICAL STUDY OF PEANUT PROTEIN IN UREA SOLUTIONS
Evans, W. J.
Arch. Biochem. Biophys. 72: 226-33. (1957)

Sedimentation and other physicochemical measurements were carried out on peanut protein dissolved in aqueous urea solutions. In 1-3M urea solutions three sedimenting species were observed; in 4-6M, two; in 7M urea, only one sedimenting species. Further studies indicate a molecular weight of about 21,000 for the protein in 7M urea solutions. It appears that this molecular species may be the "basic unit" of peanut storage globulin.

1236. MEAL RECYCLING METHOD OF SOLVENT-EXTRACTING OILSEEDS OF HIGH FAT CONTENT: APPLICATION TO FILTRATION-EXTRACTION OF PEANUTS
Pominski, Joseph; Vix, H. L. E.; and Pollard, E. F.
J. Am. Oil Chemists' Soc. 32: 565-67. (1955)

A modification of the solvent extraction method for oilseeds of high fat content is described. Portions of materials which have been solvent-extracted and completely desolventized by drying are added back to the unextracted raw flakes. The extraction rate is substantially increased, and the quantity of fines substantially reduced. Prepressing, cooking, resizing and reforming prior to extraction are eliminated. When the method was applied to raw peanut flakes, the mass velocity was increased from 112 to 2850 pounds per hour, yielding an extracted meal containing less than 1% residual lipids. The method, applied to filtration-extraction of peanuts in the laboratory, should be applicable to any type oilseed, and any type of solvent extraction, and make possible solvent extraction of oilseed previously considered unsuitable for processing by this method.

1152. NEW INFORMATION ABOUT AN OLD CROP--PEANUTS
Baringer, K. L.
Gard. J. New York Bot. Soc. 5(1): 6-9. (1955)

More than a decade of intensive research on the chemistry and technology of the peanut is reviewed. Following a brief discussion of the botanical and cultural background of peanuts, their structure and constituents are discussed. Research at the Southern Utilization Research Branch has covered

moisture content, effect of storage conditions, and heat properties. Studies on methods to improve stability of peanut oil have resulted in isolation and investigation of tocopherols of peanuts. Effect of heat on properties of peanut oil, and methods of improving quality of peanut butter have been studied; a substitute for olive oil as a lubricant in the textile industry, a new fiber from peanut protein, and a solvent extraction process for peanut oil have been developed.

1154. FILTRATION-EXTRACTION OF PEANUTS ON A BENCH SCALE
Pominski, Joseph; Knoepfler, N. B.; Graci, A. V., Jr.; Molaison, L. J.; Kulkarni, B. S.; and Vix, H. L. E.
J. Am. Oil Chemists' Soc. 32: 361-64. (1955)

Filtration-extraction has been successfully applied to peanuts on a bench scale. The results indicate that there should be little difficulty in adapting this process on a pilot plant or commercial scale. Data show that the optimum conditions for preparing peanut flakes of approximately 0.010 inches thickness for filtration-extraction are: preheating to approximately 170° F., moisture addition of 10-12.5%, cooking and drying at 190° to 220° F., crisping, rerolling through rolls set at 0.003 inches, and ending with a final moisture of about 7%. In the filtration-extraction of the prepared peanut flakes, a slurrying time of 30 minutes and a solvent-to-meal ratio of 1.5 to 1.0 are adequate. Mass velocities of 2800 to 4800 lbs./sq.ft./hr. are obtained and residual lipids in the extracted meal are approximately 1%. These mass velocities are suitable for commercial use. The extracted meals have a protein solubility of about 80%.

1103. PEANUT BUTTER. VI. THE EFFECT OF ROASTING ON THE PALATABILITY OF PEANUT BUTTER
Morris, N. J.; and Freeman, A. F.
Food Technol. 8: 377-80. (1954)

Peanut butters prepared in the pilot plant from peanuts roasted to various extents were evaluated periodically to determine the effect of the extent of roasting accorded the peanuts on flavor characteristics during two years' storage. Taste panel data show that in the opinion of the panel peanut butters from medium-roasted peanuts exhibited the most desirable flavor and good flavor retention.

1106. CONTINUOUS ENRICHMENT OF PEANUT BUTTER WITH VITAMIN A
Willich, R. K.; and Freeman, A. F.
Food Eng. 26(8): 129, 131, 166. (1954)

Equipment for the continuous delivery of materials required in the manufacture of peanut butter fortified with vitamin A has been described. Results of measurements with this equipment of the rates of delivery of roasted peanuts, hydrogenated peanut oil, salt, and peanut oil to serve as a carrier for vitamin A indicated a high degree in uniformity of delivery. No significant changes in rate of delivery were found upon reduction of the "head" or supply of material contained in the hoppers.

1107. PEANUT BUTTER. VIII. EFFECTS OF PROCESSING AND STORAGE ON VITAMIN A INCORPORATED IN PEANUT BUTTER
Willich, R. K.; Morris, N. J.; O'Connor, R. T.; and Freeman, A. F.
Food Tech. 8: 381-84. (1954)

The effects of processing temperatures and conditions of storage on the vitamin A palmitate incorporated in peanut butter have been investigated. While no significant losses could be attributed to temperature only, a definite but small loss in vitamin A may be attributed to the inclusion of atmospheric oxygen, and to frictional heat produced in the manufacture of the product. The content of vitamin A incorporated in peanut butter remained satisfactorily high, although reduced, after storage of the product for 6 months at either 80° or 100° F.

1019. PEANUT BUTTER
Freeman, A. F.; Morris, N. J.; and Willich, R. K.
U. S. Dept. Agr. Bur. Agr. Ind. Chem. AIC-370. 61 pages.
Processed. (1954)

Sixteen scientific papers by members of SURB pertinent to the manufacture of peanut butter are reviewed, plus 82 publications by other investigators. Effects of roasting and other processing operations and effects of storage on the development of rancidity, thiamin content, and extent of oil separation were studied through production of butters on pilot-plant equipment, followed by chemical analyses and taste panel tests. Some methods for evaluating peanut butter and constituents were modified to give a better measurement; for instance, reflectance spectrophotometry was established as an objective measurement of the color of peanut butter. The nature of the stabilizing effect of hydrogenated peanut oil in peanut butter and composition of peanuts from different varieties as related to the stability of the derived oils were studied. Processes for the incorporation of vitamin A in peanut butter were evaluated; and an improved, continuous process was developed.

1088. PROCESS FOR THE PRODUCTION OF SUBSTANTIALLY SKIN-FREE PEANUT KERNELS
D'Aquin, E. L.; Pominski, J.; Molaison, L. J.; and Vix, H. L. E.
U. S. Patent No. 2,687,155. August 24, 1954

This is a method of blanching peanuts so that substantially all of the skins are removed, to produce a color-free source of peanut protein. Peanuts are immersed in water until they absorb a specified amount, the moist peanuts are dried at a moderate temperature until they have a specified moisture content, and the peanuts so treated are blanched in the usual manner.

1109. UTILIZATION RESEARCH ON PEANUTS
Altschul, A. M.
Peanut J. and Nut World 33(9): 11, 12, 39. (1954)

There is a surplus of peanuts in the United States--about 62 million pounds in 1954. Utilization research is the most promising approach towards meeting this problem. The status of research on peanuts at this Laboratory is reviewed. It is mentioned that 92 publications have been issued on this research. A conference held at this Laboratory attended by representatives

of the industry and researchers of various agencies indicated that research would be done to improve the quality of peanuts.

1023. SOLUBILITY OF HYDROGENATED PEANUT OIL IN PEANUT OIL
Magne, F. C.; Skau, E. L.; and Freeman, A. F.
J. Am. Oil Chemists' Soc. 31: 113-14. (1954)

The principal process used to prevent the separation of peanut butter into an oil phase and a meal phase involves the uniform incorporation of small amounts of hydrogenated peanut oil. Solubility measurements have been made for a commercial hard peanut fat in a refined and bleached peanut oil. The nature as well as amount of solid crystals present in the oil is important; under controlled conditions any amount of the high-melting modification of the hard fat incorporated in peanut oil above the solubility temperature in excess of 2% should produce a mixture free from oil separation under average storage conditions.

1016. PHASE RELATIONS PERTAINING TO THE SOLVENT WINTERIZATION OF CRUDE PEANUT OIL IN 85-15 ACETONE-HEXANE MIXTURE
Boucher, R. E.; and Skau, E. L.
J. Am. Oil Chemists' Soc. 31: 268-70. (1954)

A process for winterizing crude peanut oil can be visualized which would involve mixing the proper proportions of the concentrated crude hexane miscella and acetone to make up a winterizable mixture of 35% by weight of oil in an 85-15 acetone-hexane mixture. Performing the winterization step before refining, bleaching, and deodorizing would result in a fully winterized salad oil and eliminate readdition of solvent and restripping. For more satisfactory crystals lower oil-solvent ratios at lower temperatures are required than for refined peanut oil. From a practical point of view, the winterization can best be carried out on a 35% oil solution in the acetone-hexane mixture at -12°C. with a 1-hour holding time.

1029. PEANUT PROTEIN: ISOLATION, COMPOSITION, AND PROPERTIES
Arthur, J. C., Jr.
Advances in Protein Chemistry, Ed. by M. L. Anson, K. Bailey, and J. T. Edsall. Vol. VIII. Pages 393-414. 1953. Academic Press, Inc., New York, N. Y. (1953)

This review cites 240 references from the world literature. Protein content of the nut or kernel is about 25%, which makes the peanut a significant source of vegetable protein for foods, feeds, and industrial products. Peanut protein consists of two principal fractions, arachin and conarachin. Very little information is available on chemical reactions of peanut protein. Nutritional value of peanut protein compares favorably with other vegetable proteins, but compared with animal proteins, it lacks lysine and methionine. Fibers, glues, sizings, and other industrial products have been made experimentally from peanut protein.

966. ELEVATION OF THE INTRINSIC VISCOSITY OF PEANUT PROTEIN BY TREATMENT WITH TEREPHTHALYL DICHLORIDE
Mann, G. E.
J. Am. Chem. Soc. 75: 3526-29. (1953)

Treatment of aqueous alkaline dispersions of peanut protein with the bifunctional acid chloride, terephthalyl dichloride ($pC_6H_4(COCl)_2$), results in modified proteins of elevated intrinsic viscosity as measured at 25.0°, using 10 M urea as the solvent. It also reduces the solubility of the protein in this solvent.

957. DETERMINATION OF MOISTURE IN PEANUT BUTTER
Pepper, M. B., Jr., and Freeman, A. F.
J. Am. Oil Chemists' Soc. 30: 335-37. (1953)

The moisture and volatile contents of whole peanuts were determined by A.O.C.S. Official Method (Ab 2-49) and compared with the moisture content of the sliced peanuts determined by a toluene distillation procedure described by Tyron (J. Research Natl. Bur. Standards 45(5): 362-366. 1950). Moisture was determined by an oven loss-in-weight technique corresponding to conditions of A.O.C.S. Official Method (Ab 3-49) for "Second" moisture, and by the toluene distillation method. Tyron's apparatus seems to make the toluene distillation procedure particularly adaptable to peanut butter.

953. PEANUT BUTTER. IV. DETERMINATION OF COLOR OF PEANUT BUTTER BY A SPECTRAL REFLECTANCE METHOD
Morris, N. J.; Lohmann, I. J.; O'Connor, R. T.; and Freeman, A. F.
Food Tech. 7: 393-96. (1953)

A reflectance spectrophotometric method was used to measure the colors of 20 peanut butter samples, ranging in color from light to very dark. This technique affords an objective means of determining color, an important index of quality of peanut butter. Other methods used involve visual comparison, providing only a subjective measurement.

952. PEANUT BUTTER. III. EFFECT OF ROASTING, BLANCHING, AND SORTING ON OIL CONTENT AND FREE FATTY ACIDS OF PEANUTS
Morris, N. J.; Willich, R. K.; and Freeman, A. F.
Food Tech. 7: 366-69. (1953)

Oil and the free fatty acids contents of the oils of raw and roasted peanuts, sorted cotyledons, germs, testa, and peanut butters were determined. Roasting, blanching, and manual sorting increased the apparent oil content of sorted peanuts about 1.5%, on the average for 20 batches. These operations led to reduction in free fatty acids of the sorted peanuts (on the average, about 0.1% less than for the corresponding raw, shelled peanuts). Peanut butters containing stabilizers as well as added salt showed increases in oil content as compared to butters with only added salt.

948. FACTORS AFFECTING THE STABILITY OF CRUDE OILS OF SIXTEEN VARIETIES OF PEANUTS
Fore, S. P.; Morris, N. J.; Mack, C. H.; Freeman, A. F.; and Bickford, W. G.
J. Am. Oil Chemists' Soc. 30: 298-01. (1953)

Composition and stability have been determined simultaneously for crude oils from known varieties of peanuts for the purpose of relating stability to composition. Relations between fatty acid compositions, tocopherol contents, and autoxidative stabilities of 16 crude oils from different varieties of peanuts have been investigated. The relative linoleic acid content is a major factor affecting variations in stabilities. With the exception of the oils from Runner peanuts tocopherol compositions of the oils did not vary significantly, either in the nature and distribution of individual tocopherols, or in total tocopherol contents. The enhanced stability of the oils from the Runner peanuts may be due in part to their higher tocopherol contents. There is some evidence that crude peanut oils contain some nontocopherol antioxidant and/or synergist.

942. PEANUT COMPOSITION IN RELATION TO PROCESSING AND UTILIZATION
Hoffpauir, C. L.
Agr. Food Chem. 1: 668-71. (1953)

Information on kinds and amounts of constituents of kernels, hearts, and red skins--considered basic to research on improving the quality of peanuts in food uses--has been compiled from 67 references from the world literature on the chemical composition of peanuts, and has been discussed in relation to processing and use. Changes brought about when kernels are roasted to improve aroma, flavor, and palatability are discussed in the light of present information on the reactions taking place.

891. BROAD ASPECTS OF RESEARCH ON UTILIZATION OF EDIBLE PEANUTS
Freeman, A. F.
Peanut J. and Nut World 32(8): 15, 39-43. (1953)

Conferences held at SRRL with representatives of the peanut industry and researchers of other Federal and State agencies are described. Peanut butter industry representatives recommended giving priority to improvement of the quality of raw peanuts and to a search for uses for hulls and for those peanuts that are undesirable for food uses. Nut-salting and confectionery industries recommended giving priority to improvement of processes for blanching, deep-fat frying, and packaging of peanut products; and that research be conducted also on improving quality of raw peanuts.

889. NOTE ON THE USE OF CALCIUM HYDROXIDE IN THE PREPARATION OF PEANUT PROTEIN
Pominski, Joseph; and Gordon, W. O.
J. Am. Oil Chemists' Soc. 30: 88-89. (1953)

Laboratory peptizations showed that between pH 7.2 and 9.5, nitrogen solubility obtained with calcium hydroxide solution was a constant, and was practically equal to the value obtained with sodium hydroxide solution at pH 7.5. Pilot-plant yields of protein and settling rates of protein curds were also equal.

883. DETERMINATION OF STABILITIES OF CRUDE PEANUT OILS BY ACCELERATED AERATION METHODS
Morris, N. J.; and Freeman, A. F.
Food Tech. 7: 227-8. (1953)

Stabilities of crude peanut oils determined at 110°C. by Mehlenbacher's modification of the active oxygen method (A.O.M.) are compared with those determined by the active oxygen method at 97.8°C. The determination at 110°C. provides a suitable objective method for the determination of stability of crude peanut oils in 40 percent of the time required by use of the active oxygen method at 97.8°C.

843. STABILITY TUBE WITH FOAM BREAKER
Fisher, G. S.; and Morris, N. J.
Anal. Chem. 24: 1384. (1952)

An all-glass stability tube is described which was developed to control excessive foaming during application of the active-oxygen method for the determination of the stability of oils extracted from peanut butter and peanuts. The tube has been used satisfactorily for approximately 2 years.

822. ESTIMATION OF SKIN CONTENT OF PEANUT MEALS AND RELATIVE SKIN PIGMENT CONTENT OF ISOLATED PROTEIN
Stansbury, M. F.; and Hoffpauir, C. L.
J. Am. Oil Chemists' Soc. 29: 370-72. (1952)

The method described is based on the fact that the pigments consist predominantly of a catechol tannin and related compounds. It may be used to estimate the degree of skin removal in preparing meals and evaluating proteins for skin pigment content.

812. PHASE RELATIONS IN THE SOLVENT WINTERIZATION OF MOLECULARLY REARRANGED PEANUT OIL AND COTTONSEED OIL
Boucher, R. E.; and Skau, E. L.
J. Am. Oil Chemists' Soc. 29: 382-85. (1952)

Systematic phase-relation data, obtained to determine the effect of either mild or extensive molecular rearrangement on the winterization behavior of peanut or cottonseed oils, show that if the molecular rearrangement step is introduced before solvent winterization, larger percentages of solid must be removed to obtain a winterized oil, especially for cottonseed oil; lower yields result; lower chilling temperatures and longer chilling periods are required, partly because of a lower rate of crystallization; and the settling qualities of the solid separating are markedly impaired.

806. FLAKE FEEDING DEVICE FOR SOLVENT EXTRACTION OF OIL-BEARING MATERIALS
Gardner, H. K.; D'Aquin, E. L.; Parker, J. S.; and Gastrock, E. A.
Ind. Eng. Chem. 44: 2261-64. (1952)

The device was developed to feed flaked oil-bearing materials to a pilot-plant size solvent extractor: To provide a continuous, uniform discharge of the material which can be varied over a 2.5 to 1 range; to form a positive

seal plug to prevent the escape of solvent vapors at the point of entry of the material; and to cause a minimum breakage of the material into very small particles. The device operated satisfactorily with flakes from cottonseed, peanuts, okra seed, and rice bran, and is of a type suitable for feeding a wide variety of materials other than oilseed flakes or meats. Scaling up to commercial size should be feasible.

754. PRODUCTION OF PEANUT PROTEIN
Pominski, Joseph; Gordon, W. O.; McCourtney, E. J.; Vix, H. L. E.; and Gastrock, E. A.
Ind. Eng. Chem. 44: 925-28. (1952)

Pilot-plant yields of protein were increased by successive peptizations and also by grinding the meal before one peptization. Operating details are given.

753. COTTONSEED AND PEANUT MEAL GLUES. RESISTANCE OF PLYWOOD BONDS TO CHEMICAL REAGENTS
Hogan, J. T.; and Arthur, J. C., Jr.
J. Am. Oil Chemists' Soc. 29: 16-18. (1952)

The resistance of birch plywood glue bonds using cottonseed and peanut meal or casein to organic and inorganic reagents for periods ranging from 1 to 14 days was determined. It was suggested that the principal attractive forces involved in the protein bonds were ionic or valence forces and that differences observed in the resistance of the glues to the chemical reagents were probably due to variations in the amino acid constitution of the proteins.

750. PEANUT PROTEIN FIBERS - FLOW CHARACTERISTICS OF SPINNING SOLUTIONS AFFECTED BY RATE OF EXTRUSION
Arthur, J. C., Jr.; and Many, H. G.
Am. Dyestuff Reptr. 41: 385-86. (1952)

In the preparation of peanut protein fiber the loss in head in a section of the extrusion system per unit volume of spinning solution delivered decreased with increasing rate of extrusion, indicating that the fluidity of spinning solutions is affected by rate of extrusion. An optimum rate of extrusion was determined for each extrusion system to minimize the loss in energy in the system per unit volume delivered.

736. STABILITY OF COTTONSEED AND PEANUT OILS TO AUTOXIDATION
Dollear, F. G.
Potato Chipper 11(11): 24, 26, 28, 30, 32. (1952)

In a study of the influence of the type and proportion of the various fatty acid components of the glycerides and the presence of natural or added antioxidants, of pro-oxidants, and of synergists and/or metal deactivators on the resistance of cottonseed and peanut oils to autoxidation, it was found that the stability of these oils can be increased by hydrogenation or by the addition of some types of antioxidants.

735. PEANUT BUTTER. II. EFFECT OF ROASTING AND BLANCHING ON THE THIAMINE CONTENT OF PEANUT BUTTER
Willich, R. K.; Murray, M. D.; O'Connor, R. T.; and Freeman, A. F.
Food Tech. 6: 199-200. (1952)

Analyses of raw, shelled peanuts after removal of the testa showed that most of the thiamine was contained in the kernel. Peanut butters made from peanuts roasted to various extents contained only a relatively small proportion of the thiamine originally present in the kernel. With increase of roasting the amounts of thiamine were progressively smaller, while the color of the product became darker. Consequently, color becomes a visual indication of the extent of roasting, and indirectly of the loss of thiamine.

734. PEANUT BUTTER. I. ROASTING, COOLING, BLANCHING, AND PICKING OF PEANUTS
Willich, R. K.; Hall, A. S.; Morris, N. J.; and Freeman, A. F.
Food Tech. 6: 71-73. (1952)

The times and temperatures required for roasting white Spanish peanuts from very light to very dark have been determined, and information has been obtained on the cooling, blanching, and manual sorting of 20 batches of peanuts in relation to their original moisture contents and to the quality of the final product.

733. PRE-TREATMENT OF PEANUT KERNELS FOR EFFECTIVE SKIN REMOVAL
Pominski, Joseph; D'Aquin, E. L.; Molaison, L. J.; Vix, H. L. E.; and McCourtney, E. J.
J. Am. Oil Chemists' Soc. 29: 48-51. (1952)

Best pilot-plant-scale conditions for approximately 98 percent skin removal from U. S. No. 1 shelled Spanish peanuts are: Water treatment at room temperature, to gain not less than 20 percent moisture, drying with forced circulated air at 120° to 125°F. to approximately 4.5 percent moisture in the peanuts, and blanching in a standard split-nut blancher. Meal prepared by hexane extraction of de-skinned (98 percent), water-treated U. S. No. 1 kernels had color and flavor characteristics superior to other hexane-extracted peanut meals for food utilization. Protein prepared from this meal had a light color.

728. SOLVENT EXTRACTION OF COTTONSEED AND PEANUT OILS. IX. DETERMINATION OF FINES IN MISCELLA
Graci, A. V., Jr.; Crovetto, A. J.; Parker, J. S.; and Reuther, C. G., Jr.
J. Am. Oil Chemists' Soc. 29: 71-73. (1952)

Cottonseed, peanuts, okra seed, and rice bran were used in experiments in which was developed a rapid method of determining the solids content of oil-solvent miscellas. The method is volumetric and replaces the slower gravimetric method. The volumetric determination is converted to weight values by the use of an appropriate curve. The construction of the curve and its application in pilot-plant operations are described.

725. PREVENTION OF OIL SEPARATION IN PEANUT BUTTER. A REVIEW
Freeman, A. F.; and Singleton, W. S.
Peanut J. and Nut World 31(4): 23, 30, 45-46. (1952)

The 27 references reviewed cover methods used for preventing the separation of oil in peanut butter and the history of the development of stabilization of peanut butter. Grinding roasted peanuts by various methods is discussed, especially with respect to the frictional heat imparted to peanut butter and the amount of oil freed from the cell structure of the peanut. Effect of controlling the temperature during grinding and subsequent steps in the manufacture of peanut butter in relation to oil separation is explained.

660. LYE-DIPPING FOR THE REMOVAL OF OBJECTIONABLE SKIN COLOR FROM VARIOUS GRADES OF SHELLED SPANISH PEANUTS
Pominski, Joseph; McCourtney, E. J.; Stansbury, M. F.; D'Aquin, E. L.; and Vix, H. L. E.
J. Am. Oil Chemists' Soc. 28: 513-16. (1951)

Experimental data have been obtained on the lipids and protein losses in the lye treatment of the various grades of shelled Spanish peanuts. It has been shown that lipid and protein losses on U. S. No. 1 shelled peanuts are lower for the cold than for the hot treatment, though both are of a low level; that these losses in the cold treatment increased with the use of lower grade shelled peanuts, U. S. No. 2 and oil mill stock; that protein solubility of kernels was negligibly affected by lye solution treatment, drying at 125°F., cold solvent extraction with hexane, air-drying and oven-drying at 125°F.; and that damaged kernels imparted color to protein.

659. PROCESSING VARIABLES IN PEANUT PROTEIN PREPARATION
Pominski, Joseph; Laborde, E. J.; Cirino, V. O.; and Vix, H. L. E.
J. Am. Oil Chemists' Soc. 28: 508-12. (1951)

A general equation was derived by which yield of protein may be calculated for a solvent-extracted peanut meal at various water-meal ratios. Experiments showed that nitrogen solubility for ground and unground meal increased slowly with temperature but was little affected by the water-meal ratio, and that peptization might be considered complete in 30 minutes. For unground meal yield of protein increased with increase in water-meal ratio. Repeated peptizations and grinding of meal led to increased protein yields.

647. PHASE RELATIONS PERTAINING TO THE SOLVENT WINTERIZATION OF PEANUT OIL IN ACETONE-HEXANE MIXTURES
Boucher, R. E.; and Skau, E. L.
J. Am. Oil Chemists' Soc. 28: 501-04. (1951)

Systematic phase relation data have been obtained on the solvent-winterization behavior of a refined peanut oil in a mixed solvent consisting of 85 percent by weight of acetone and 15 percent of hexane. Graphs are given which show the effect of oil-solvent ratio, chilling temperature, holding-time, and agitation on the percentage of solid removed, the degree of winterization, and the settling qualities of the solid separating. The

data afford a preliminary basis for pilot-plant design, selection of optimum conditions, and recognition of limitations for pilot-plant research on the solvent winterization of peanut oil.

553. COTTONSEED AND PEANUT MEAL GLUES: PERMANENCE OF PLYWOOD GLUE JOINTS AS DETERMINED BY INTERIOR AND EXTERIOR ACCELERATED CYCLIC SERVICE TESTS
Hogan, J. T.; and Arthur, J. C., Jr.
J. Am. Oil Chemists' Soc. 28: 272-74. (1951)

Data on the strength properties of cottonseed and peanut meal glues in plywood bonds as they are affected by accelerated interior and exterior cyclic service tests show that cottonseed meal glue is superior to peanut meal glue; (compares favorably with commercial casein glue on an interior test basis for 5 cycles).

643. LIST OF SRRL PUBLICATIONS AND PATENTS, 1944-1950, ON COTTONSEED AND PEANUT PROTEINS AND RELATED SUBJECTS
Anonymous
U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-314.
Processed. 12 pp. (1951)

Of 71 publications by members of the Southern Utilization Research Branch reporting their accomplishments in research on these proteins, 49 pertain to peanut protein. Of these, 5 articles are reviews of the literature; 13 pertain to protein chemistry; 8 to processing of peanut protein; 2 to nutritional aspects; 4 to the production of peanut protein fiber; 9 to peanut protein composition; and 8 to the production of adhesives and sizes from peanut protein.

549. VISCOSITIES OF COTTONSEED AND PEANUT OIL-HEXANE MISCELLAS IN ENGLISH UNITS
Decossas, K. M.; Deckbar, F. A., Jr.; and Hecker, J. L.
U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-304.
Processed. 2pp., illus. (1951)

Constant composition curves of viscosity versus temperature for refined and winterized peanut oil-commercial hexane miscellas are included. Tables of viscosities of miscellas at various temperatures and compositions were converted from data in metric units to English units and plotted as intermediate viscosity-composition isotherms. Readings of viscosity versus temperature taken off these intermediate curves were plotted. Absolute viscosity, as ordinate expressed in pounds per foot-hour, and temperature, t, as abscissa expressed in degrees Fahrenheit, were plotted. These graphs are complementary to others in English units on boiling points, densities, and gravities of oil miscellas.

546. UTILIZATION RESEARCH ON PEANUT MEAL AND PROTEIN AT THE SOUTHERN REGIONAL RESEARCH LABORATORY
Arthur, J. C., Jr.
Peanut J. and Nut World 30(8): 21-22, 53. (1951)

This article summarizes SRRL research, which has demonstrated that peanut meal and protein have many of the properties desired for making new food and

industrial products. SRRL has been the only source in this country of pilot-plant quantities of low-temperature, solvent-extracted peanut meal and protein, and has supplied samples of these products to industrial concerns and university laboratories for nutritional experiments. It is pointed out that additional fundamental information on peanut protein would be advantageous.

580. PEANUT PROTEIN FOR INDUSTRIAL USE
Arthur, J. C., Jr.
Yearbook of Agr., (U. S. Dept. Agr.) 1950-1951. pp. 611-14.

Research directed toward increasing the value of the meal and protein from peanuts, with principal aim of developing industrial products, is discussed. A typical process for separating protein from solvent-extracted peanut meal is described. Several products produced from the peanut meal and protein are described.

506. THERMAL PROPERTIES OF FATS AND OILS. VII. HYDROGENATED AND UNHYDROGENATED PEANUT OILS
Ward, T. L.; and Singleton, W. S.
J. Am. Oil Chemists' Soc. 27: 423-26. (1950)

It is believed that this investigation is the first reported on the heat capacity of peanut oils. A refined and bleached peanut oil was examined calorimetrically before and after hydrogenation. Measurements were made over the entire range of melting. Values for specific heats were used to develop equations relating temperature and specific heat of the oils in both solid and liquid states. The heat of fusion of both samples was also determined. The relative amounts of solid and liquid glycerides in hydrogenated and unhydrogenated peanut oil at various temperatures over their entire melting ranges were estimated from the calorimetric data.

505. THE TANNIN AND RELATED PIGMENTS IN THE RED SKINS (TESTA) OF PEANUT KERNELS
Stansbury, M. F.; Field, E. T.; and Guthrie, J. D.
J. Am. Oil Chemists' Soc. 27: 317-21. (1950)

Red skins (testa) represent from 2.0 to 3.5 percent of peanut kernels and contain tannin and related pigments which will contribute to the presence of undesirable color in the protein preparations. An investigation showed that the tannin is a catechol-type, the purified tannin representing about 7 percent of the weight of the skins. Much smaller quantities of phlobaphene and so-called "leuco-anthocyanic chromogen" were isolated from the skins. Some evidence of traces of a flavonic-type pigment was obtained. The tannin when refluxed with alcoholic hydrochloric acid gave a water-soluble red pigment which appeared to have an oxonium-type structure. Elementary analyses and certain properties of the isolated tannin and related pigments differed considerably from those reported by previous investigators.

502. PHASE RELATIONS PERTAINING TO THE SOLVENT WINTERIZATION OF COTTONSEED AND PEANUT OILS IN ACETONE
Skau, E. L.; Burleigh, E. G.; Banowetz, L. F.; and Dopp, W. N.
J. Am. Oil Chemists' Soc. 27: 556-64. (1950)

Systematic physical-chemical data on the solvent-winterization behavior of cottonseed and peanut oils with acetone have been obtained which should serve as a basis for selecting the conditions necessary for the effective solvent winterization of these oils in acetone. The two oils are only partly miscible with acetone below certain temperatures which have been determined. In peanut oil this phenomenon may interfere with the winterization process within a certain range of concentrations. It seems probable that if acetone were used as the winterization solvent for the peanut oil, the separation into two liquid layers and the sensitivity of this phenomenon to moisture might be a source of processing difficulties especially if filtration instead of centrifugation were used to separate the solid from the supernatant.

501. EXPANSIBILITY AND SPECIFIC VOLUME OF STABILIZED AND UNSTABILIZED PEANUT BUTTER
Singleton, W. S.; and Freeman, A. F.
Food Research 15: 297-301. (1950)

Peanut butter of 3 different compositions was examined dilatometrically. From data on expansibility and absolute density, absolute specific volume of each peanut butter was calculated for various temperatures from -38.6° to 70.0°C. No evidence of polymorphic transformations was obtained, regardless of rates of cooling of the samples. The reported data may be applied to the calculation of the shrinkage of peanut butter which may occur after packaging as a result of natural cooling of the product to room temperature.

492. DENSITIES AND GRAVITIES OF COTTONSEED AND PEANUT OIL MISCELLAS IN ENGLISH UNITS
Decossas, K. M.; Deckbar, F. A., Jr.; and Hecker, J. L.
U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-292.
Processed 2 pp., illus. (1950)

Data in the literature on density-temperature-constant composition parameters for refined and winterized peanut oil-commercial hexane miscellas are replotted in English units; namely, densities in pounds per cubic foot and per gallon, and temperatures in degrees Fahrenheit. The specific gravities are calculated on a basis of the density of water at 60°F. These plots complement those in English units on boiling points of cottonseed and peanut oil miscellas. Re-plotting these data will render them more useful and suitable for design calculations, plant operations, and interpretations of operating data.

487. PEANUT PROTEIN FIBERS--PILOT-SCALE PLANT
Arthur, J. C., Jr.; and Many, H. C.
Am. Dyestuff Reptr. 39: 719-22. (1950)

The construction and operation of a pilot-scale fiber-spinning plant are described and typical operating data for the plant are presented.

462. HEAT CAPACITY OF STABILIZED PEANUT BUTTER
Ward, T. L.; Singleton, W. S.; and Freeman, A. F.
Food Research 15: 146-49. (1950)

A calorimeter was modified and used to measure the heat capacity of peanut butter. The heat capacity of a sample of peanut butter which had been rapidly cooled after emerging from the grinding mill was 0.075 calorie per gram higher than the same sample when slowly cooled, up to the final melting of the added hard fat which was present in the sample. Identical heat capacities were observed above 19°C., regardless of the rate of cooling of the sample. An equation was developed for expressing the heat capacity of peanut butter in the range 20° to 80°, which is $C_p = 0.361 + 0.0012\ t$.

458. ISOLATION OF XANTHINE, GUANINE, ADENINE, PROTEOSE, OLALIC ACID, AND GLUTATHIONE FROM PEANUT KERNELS
Reeves, W. A.; and Guthrie, J. D.
Arch. Biochem. 26(2): 316-18. (1950)

Xanthine, guanine, and adenine, a proteose, and oxalic acid were isolated from the supernatant liquid remaining after the precipitation of peanut protein. X-ray diffraction data were obtained for xanthine and for the gold chloride double salts of guanine and adenine. Glutathione was isolated from an alcoholic extract of peanut kernels. None of these substances have been previously isolated from peanut kernels.

452. ELECTROPHORETIC ANALYSIS OF PEANUT AND COTTONSEED MEALS AND PROTEINS
Karon, M. L.; Adams, M. E.; and Altschul, A. M.
J. Phys. and Colloid Chem. 54(1): 56-66. (1950)

Cottonseed and peanut meals and the derived proteins were analyzed by means of the Tiselius electrophoresis apparatus. The effects of method of extraction of the protein and of the buffer and pH of the buffer solutions were investigated. By fractional precipitation involving a change of ionic strength, the two major components of cottonseed protein can be concentrated to above 80 percent purity. Approximately 75 percent of peanut protein consists of two components. These migrate as a single entity, unless the meal has been pre-washed to remove soluble sugars and phytin, in which case the two major components separate into two almost equal fractions.

447. BOILING POINTS OF COTTONSEED AND PEANUT OIL MISCELLAS IN ENGLISH UNITS
Decossas, K. M.; Mackey, H. A.; and Houghan, G. F.
U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-257. 2pp., illus. Processed. (1950)

Data in the literature on boiling point vapor pressure-constant composition parameters for crude cottonseed oil-commercial hexane miscellas and crude peanut oil-commercial hexane miscellas have been plotted in inches of mercury vacuum and in degrees of temperature Fahrenheit to make them more useful and suitable for design calculations, plant operations, and interpretations of operating data. Constant composition parameters are at 0, 50, 60, 70, 80, 85, 90, 93, 95, 97, and 98 percent oil by weight.

635. PREPARATION OF PEANUT PROTEIN FREE FROM PEANUT SKIN PIGMENTS
Burnett, R. S.
U. S. Patent No. 2,463,740. March 8, 1949.

Shelled, unskinned kernels are exposed for a few seconds to a dilute aqueous alkaline solution to remove pigment from the skins, then are washed, partly dried, and separated into oil and light-colored meal, from which a high-quality protein may be obtained. Also described is similar removal of soluble pigments in kernels by a few seconds' exposure to dilute acid.

456. ABSTRACT BIBLIOGRAPHY OF THE CHEMISTRY AND TECHNOLOGY OF PEANUTS, 1830-1939
Morris, N. J.; and Dollear, F. G.
U. S. Dept. Agr., Bur. Ind. Chem., AIC-151. Processed. 231 pp. (1949)

This is a compilation of abstracts of more than 600 references, published from 1830-1939, with references arranged under these subject divisions: (1) Peanuts--agronomy, analysis and composition, food products, nutrition, processing, protein and enzymes; (2) peanut cake--analysis, feed, nutrition, utilization; (3) peanut oil--adulteration and detection, chemical and physical properties, nutrition, processing, stability, utilization; (4) peanut shells and byproducts; (5) miscellaneous. Included are subject and author indexes. A widespread demand for copies has testified to the significance of this bibliography for all who are interested in peanut utilization.

418. MODIFICATION OF VEGETABLE OILS. VIII. CONVERSION OF MONOESTERS OF PEANUT OIL FATTY ACIDS TO TRIGLYCERIDES
Gros, A. T.; and Feuge, R. O.
J. Am. Oil Chemists' Soc. 26: 704-09. (1949)

Conversion of the methyl and ethyl esters of peanut oil fatty acids into triglycerides through alcoholysis and ester-ester interchange reactions was investigated to establish the conditions for the most rapid and complete transformation. The most effective catalysts for alcoholysis were barium hydroxide, lithium hydroxide, sodium ethylate, and sodium hydroxide. When equivalent quantities of monoesters were allowed to interact, the initial rate of alcoholysis was influenced markedly by the temperature and concentration of catalyst and to some extent by the pressure. Monoesters were converted fairly completely into triglycerides by reacting with an excess of glycerol and then decomposing the resulting glycerides by heating and stripping with steam under low pressure. Ester-ester interchange reactions using triacetin and methyl or ethyl esters did not proceed as well as has been reported in the literature.

413. PEANUT PROTEIN FOR WINDOW SHADE SIZES
Arthur, J. C., Jr.; and Cheng, F. W.
Am. Dyestuff Reptr. 38: 535-37. (1949)

Experiments indicate the suitability of peanut protein for use as a sizing material in window shade manufacture and in similar applications. In the

laboratory, cotton muslin sized with peanut protein solutions showed tensile and flexibility characteristics similar to those of samples sized commercially with animal glues. Peanut protein also is satisfactory for many other adhesive uses. The cost of isolating and processing peanut protein compares favorably with the cost of producing other industrial proteins, and the potential supply is large.

412. PEANUT PROTEIN FOR INDUSTRIAL UTILIZATION. A LITERATURE SURVEY
Arthur, J. C., Jr.
J. Southern Res. 1(4): 6-14. 1949.
Condensed version. Evaluation of Peanut Protein for Industrial Utilization: A Review:
J. Am. Oil Chemists' Soc. 26(11): 668-71. (1949)

Reviewed are 136 references on commercial and laboratory processes for producing peanut meal, extracting and isolating protein, and producing and evaluating products made from the protein. Solvent-extracted peanut meal is a good source of protein for industrial products. Physico-chemical properties of peanut protein fractions in colloidal solutions determine industrial applications. Procedures have been established by the Southern Utilization Research Branch for determining solubility of protein in different solvents; nitrogen and ash contents; color of protein dispersed in sodium hydroxide solutions; viscosity characteristics of concentrated protein solutions; and properties of specific products made from protein.

411. MORE PRODUCTS FROM PEANUTS
Arthur, J. C., Jr.
Mfrs. Rec. 118(10): 40-1. (1949)

Research at SRRL directed towards increasing the value of peanut oil and meal is reviewed. Pilot-plant manufacture of peanut protein and its use in making a soft, wool-like, cream-colored fiber and such adhesive products as plywood glue, rewettable glues, paper-coating binders, and window shade sizes are described. Commercial development of these industrial products from peanuts will depend on commercial availability of peanut meal of certain specifications.

395. HYGROSCOPIC EQUILIBRIUM OF PEANUTS
Karon, M. L.; and Hillery, B. E.
J. Am. Oil Chemists' Soc. 26: 16-19. (1949)

The hygroscopic equilibrium curve for whole peanuts--obtained over a range of 11 to 93 percent relative humidity at 25°C.--proved to be similar to that of cottonseed. All samples investigated (regardless of variety or the manner in which they were dried) exhibited very similar results. In the whole peanut, the shells contained more moisture than the kernels; however, the kernels contained a large percentage of oil, which is responsible for some of the observed differences in moisture content. In the kernel the skins contained the greatest percentage of moisture at constant relative humidity. Circulation of air over the samples and a raise in temperature to 35° greatly increased the rate at which hygroscopic equilibrium was attained.

392. MODIFICATION OF VEGETABLE OILS. VII. ALKALI-CATALYZED INTERESTERIFICATION OF PEANUT OIL WITH ETHANOL
Feuge, R. O.; and Gros, A. T.
J. Am. Oil Chemists' Soc. 26: 97-102. (1949)

The alkali-catalyzed displacement of the glycerol in a fat by methanol or ethanol is an important reaction in fat and oil technology. The reaction simplifies the manufacture of some soaps, is valuable in conjunction with processes for fractionating fatty acids, and potentially is important in producing mono- and diglycerides of unsaturated acids, and presents possibilities in the field of "tailor-made" fats. In this article, data are presented to show the actual rate of alcoholysis and how it is affected by the concentration of catalyst and alcohol, as well as the rate of catalyst disappearance through saponification. The formation of mono and diglycerides during the course of alcoholysis and the mechanism of the reaction are discussed in terms of the composition of the reaction product.

355. STORAGE OF COTTONSEED AND PEANUTS UNDER CONDITIONS WHICH MINIMIZE SPECTROPHOTOMETRIC CHANGES IN THE EXTRACTED OIL
Pons, W. A., Jr.; Murray, M. D.; O'Connor, R. T.; and Guthrie, J. D.
J. Am. Oil Chemists' Soc. 25: 308-13. (1948)

This work was undertaken in an effort to establish new indexes of deterioration and to further verify previous recommendations for the storage of cottonseed and peanuts. Oil extracted from peanuts stored for more than 4 years at room temperature showed a much greater absorption in the region of 227 to 234 mμ than oil from peanuts stored at 1° or at -18°C.

353. CONTINUOUS SOLVENT EXTRACTION OF COTTONSEED AND PEANUTS AT THE SOUTHERN REGIONAL RESEARCH LABORATORY
Gastrock, E. A.; and D'Aquin, E. L.
Oil Mill Gaz. 55(4): 13-21. (1948)

The Southern Laboratory's pilot plant equipment for studying continuous solvent extraction of oilseeds is described, and the course of the solvent and meal in the process is followed diagrammatically. Various difficulties encountered before relatively smooth operation of the plant was achieved are enumerated, along with the steps taken to overcome them. In the later runs, both cottonseed and peanut flakes were extracted to a content of 1 percent, or less, of residual oil. Methods are given for the preparation for extraction of both cottonseed and peanut flakes.

350. THE NUTRITIVE VALUE OF PEANUT CAKE, MEAL, PROTEIN AND NONPROTEIN RESIDUE FOR CHICKS
Altschul, A. M.; Irving, G. W., Jr.; Guilbeau, W. F.; and Schaefer, H. C.
Poultry Sci. 27: 402-07. (1948)

The nutritive value of peanut meals, isolated protein fractions and protein meal residues obtained by various processing methods was invetigated in comparison with soybean and cottonseed meals as the supplement in chick starting diets. The feeding experiments are described in detail, and the results tabulated. Used as about one-fourth of the protein supplement in

an otherwies adequate diet, peanut meals supported chick growth as well as commercial screw-pressed soybean meal, and were only slightly inferior to commercial hydraulic-pressed cottonseed meal. Solvent-extracted peanut meal had the same nutritional value as hydraulic-pressed peanut meal. Peanut protein preparations produced gains in weight similar to those obtained by feeding the original peanut meals. The residue remaining after extraction of protein from solvent-extracted peanut meal supported growth, but had less nutritional efficiency, expressed as the amount of feed required to produce a unit gain in weight, than either peanut meal or isolated peanut protein.

345. PILOT-PLANT MANUFACTURE OF PEANUT PROTEIN
Arthur, J. C., Jr.; Crovetto, A. J.; Molaison, L. J.; Guilbeau, W. F.; and Altschul, A. M.
J. Am. Oil Chemists' Soc. 25(11): 398-400. (1948)

An improved, simplified process for producing higher yields of protein from solvent-extracted peanut meal is described. As the rate of addition of sulfur dioxide was increased, and the temperature of the extract liquor decreased, density and settling rate of the protein curd increased. Spray washing of the extracted meal was more efficient than the dilution method of washing, and increased yield of protein.

344. PEANUT PROTEIN PAPER COATINGS
Arthur, J. C.; Mason, T. W., Jr.; and Adams, M. E.
J. Am. Oil Chemists' Soc. 25: 338-40. (1948)

Paper when coated with peanut protein adhesive and mineral pigments gave high wax pick tests. Using neutralized protein as the adhesive, coating slips containing 40 percent solids were prepared with pH values as low as 6.3; and when these slips were applied to rawstock, the coating had wax pick values satisfactory for many printing operations. Over a pH range of 8 to 12, coatings prepared from unwashed protein gave high wax pick values; those prepared with water-washed protein, slightly lower values.

319. DIFFUSION PHENOMENA IN SOLVENT EXTRACTION OF PEANUT OIL
Fan, H. P.; Morris, J. C.; and Wakeham, H.
Ind. Eng. Chem. 40(2): 195-99. (1948)

Theory of diffusion extraction of oil from a porous solid is examined in the light of previous investigations on solvent extraction of oilseeds. Peanut kernels were prepared and extracted in such a manner as to meet the conditions required by Fick's law. The diffusion coefficient under these conditions varies with solvent and with the moisture content of the oilseeds, but is essentially independent of the thickness of the peanut sections extracted. Results with peanut sections follow theory closely when the broken cells at the surfaces and the void spaces due to moisture loss are considered. Techniques and conclusions presented may help in studying extraction from other oilseed systems.

289. STORAGE OF COTTONSEED AND PEANUTS UNDER CONDITIONS WHICH MINIMIZE CHANGES IN CHEMICAL COMPOSITION
Stansbury, M. F.; and Guthrie, J. D.
J. Agr. Research 75(2): 49-61. (1947)

Analysis of peanut samples stored at room temperature, 0°C., and -18°C. showed that unshelled peanuts may be stored for more than 2 years in closed cans at 1° or below without appreciable change in total nitrogen and oil contents of kernels, free fatty acid content, and iodine number of the oil.

288. THE ROLE OF CHEMISTRY IN ADAPTING PEANUTS TO NEW USES
Scott, W. M.
Peanut J. and Nut World 27(1): 47-8, 90-2. (1947)

Emphasis is placed on products obtained from peanut protein, such as a wool-like fiber and several adhesive materials. Special procedures for solvent extraction of peanuts are described which result in essentially oil-free, solvent-free meal containing high-quality protein, suitable as a source for these new, useful products. Research on the properties of peanut oil is discussed, and plans to initiate research on peanut butter are mentioned. Earlier wartime research is summarized.

286. ETHANOL-EXTRACTABLE NONPROTEIN MATERIAL IN PREPARATIONS OF PEANUT PROTEIN
Hoffpauir, C. L.; and Guthrie, J. D.
J. Am. Oil Chemists' Soc. 24: 393-97. (1947)

Steps in the preparation of protein from solvent-extracted peanut meal and the nature and amounts of nonprotein constituents extracted by cold ethanol at the curd stage are discussed. Moisture, ash, nitrogen, phosphorus, and lipids contents of original meal samples, meal residues, and the air-dried and alcohol-washed proteins are reported.

262. VEGETABLE PROTEIN HYDRATES
Burnett, R. S.; and Roberts, E. J.
U. S. Patent No. 2,421,113. May 27, 1947.

A process for preparing fluid, comparatively stable, and relatively clear vegetable protein hydrates consists of forming a mixture of water and protein, the quantity of water being about 50 percent of the hydrate, which has a pH of about 7.0.

260. PEANUT PROTEIN FIBER: ITS POSITION IN THE PROTEIN FIBER WORLD
Scott, W. M.
Chemurgic Dig. 6(12): 192-95. (1947)

The status of various protein-based synthetic fibers is surveyed. Production of the peanut protein fiber "Sarelon" at the SRRL and economic and technological aspects of the production of synthetic protein fibers are discussed. The major problem in utilizing certain oilseeds is obtaining a meal of satisfactory quality in commercial quantities.

257. SOLVENT EXTRACTION OF COTTONSEED AND PEANUT OILS. IV. PILOT PLANT BATCH EXTRACTIONS
Pominski, Joseph; Molaison, L. J.; Crovetto, A. J.; D'Aquin, E. L.; Westbrook, R. D.; and Guilbeau, W. F.
Oil Mill Gaz. 51(12): 33-39. (1947)

Experience gained in batch solvent extraction of cottonseed and peanuts is reported. The portable batch solvent extraction plant and apparatus used are described and illustrated, and typical extraction data obtained are tabulated. Batch extraction has been found indispensable for preparing relatively large batches of oils and of defatted cottonseed and peanuts and other oilseeds for use in pilot-plant work and in chemical, nutritional, protein, and other investigations. The plant has proved a valuable tool for obtaining pertinent processing and development data, including information on equipment and operating methods.

232. PROCESS OF RECOVERING PEANUT PROTEIN
Irving, G. W., Jr.; Merrifield, A. L.; Burnett, R. S.; and Parker, E. D.
U. S. Patent No. 2,405,830. August 13, 1946.

Different protein fractions can be produced from peanut meal by adjusting the pH of an aqueous extract of proteins obtained from substantially oil-free peanut meal to specific values in succession and removing the protein fractions thus precipitated at each pH value. Proteins are obtained which have widely different physical and chemical characteristics and are suitable for a variety of uses in adhesives, sizes, paper coatings, cold water paints, films, and fibers.

225. FIBER FROM PEANUT PROTEIN. I. THE PRODUCTION AND PROPERTIES OF SARELON
Merrifield, A. L.; and Pomes, A. F.
Textile Res. J. 16: 369-77. (1946) (Reprints not available)

A fiber (Sarelon) is described which has been spun from peanut protein by a "wet" process in a manner similar to that employed for viscose rayon production. A specially designed apparatus which permits the spun fiber to be stretched and strengthened and the general methods of manufacture are described. Sarelon is light cream-colored in its natural state, has a soft hand and a warmth similar to that of wool, and an affinity for dyes normally used on protein fibers and may be dyed with vat and direct cotton dyes. When dibutyl tartrate, diglycol laurate, and oil were employed in the protein spinning solution and when the resulting fiber was aftertreated in a solution of sodium chloride, hydrochloric acid, and formaldehyde, the fiber had a dry strength of 0.67 gram per denier, a wet strength of 0.18 gram per denier, and dry and wet elongations of 11.8 and 22.0 percent, respectively.

219. PROTEIN-PHYTIC ACID RELATIONSHIP IN PEANUTS AND COTTONSEED
Fontaine, T. D.; Pons, W. A., Jr.; and Irving, G. W., Jr.
J. Biol. Chem. 164(2): 487-507. (1946)

The protein-phytic acid solubility relation over a wide pH range has been determined for peanut and cottonseed meals and for the dialyzed meals and

isolated proteins, and the theoretical and practical significance of the acid relation is discussed. Some comparative data on soybean meal are included. A few characteristics of the phytase present in the meals are described. The data establish that the naturally occurring phytic acid in seed meals is responsible for the suppression of the solubility of the seed meal proteins at pH values below their isoelectric points.

217. PEANUT-MEAL PLYWOOD GLUE
Burnett, R. S.; and Parker, E. D.
Trans. Am. Soc. Mech. Eng. 68(October): 751-56. (1946)

Specifications have been established for a peanut meal suitable for use in preparing plywood glue; a satisfactory glue formula has been developed; and information has been obtained concerning the behavior of the glue under varying conditions. Maximum cooking temperatures of 210° to 215°F. for 76 to 80 minutes produced a suitable meal in experiments; but each mill has to determine its own most favorable conditions of time and temperature for preparing the specified meal. The dry and wet plywood shear test, the block shear test, and the measurement of viscosity show that peanut meal glue of the formula given meets requirements established for casein and casein-type glues. A plant-scale formula with details for preparing the glue mixture is given.

197. PEPTIZATION OF PEANUT AND COTTONSEED PROTEINS. EFFECT OF DIALYSIS AND VARIOUS ACIDS
Fontaine, T. D.; Irving, G. W.; and Markley, K. S.
Ind. Eng. Chem. 38: 658-62. (1946)

While the shapes of the pH- peptization curves for cottonseed and peanut meals differ, the response of their proteins to the removal of dialyzable meal constituents is the same, showing that naturally occurring substances present decrease markedly the peptizability of the meal nitrogen at certain acid pH values but exerts no effect at alkaline pH values.

195. MANUFACTURE AND USE OF PEANUT PROTEIN
Burnett, R. S.
Chem. Eng. News 24: 478-80. (1946)

The preparation of peanut protein, useful in making adhesives and fibers, by alkali extraction of solvent-extracted or hydraulic-pressed peanut meal is described. To obtain satisfactory color in the extracted protein, either white-skinned peanuts must be used or, before processing the kernels for oil and meal the red color may be removed from the skins. A flow sheet is given and processing costs are estimated.

34. OIL AND MEAL YIELDS IN PEANUT MILLING
Dollear, F. G.; Hoffpauir, C. L.; and Feuge, R. O.
Oil and Soap 23(2): 45-8. (1946)

A continuous processing test was made in a commercial (hydraulic press) oil mill to determine the nature and amount of the so-called invisible oil loss which has been reported to occur in milling peanuts. Three hundred and thirty tons of farmers' stock peanuts were crushed for oil and all products entering and leaving the mill were weighed, sampled, and analyzed. The yields of oil

and meal were compared with the yields predicted on the basis of chemical analysis. Under the conditions of this processing test run no so-called invisible oil loss was observed.

157. U. S. MANUFACTURERS OF EQUIPMENT FOR PROCESSING COTTONSEED AND PEANUTS INTO OIL, MEAL AND BYPRODUCT
Anonymous
U. S. Dept. Agr., Bur. Agr. Ind. Chem. AIC-98.
Processed. 8 pp. (1945) Revised 1947

This is an alphabetical list of most of the manufacturing companies serving processors of cottonseed and peanuts. A cross listing is given under the type of equipment manufactured.

154. SOLVENT EXTRACTION OF COTTONSEED AND PEANUT OILS. BOILING POINT-VAPOR PRESSURE-COMPOSITION RELATIONS FOR MISCELLAS OF OILS IN HEXANE
Pollard, E. F.; Vix, H. L. E.; and Gastrock, E. A.
Ind. and Eng. Chem. 37: 1022-26. (1945)

Boiling points and densities of mixtures of cottonseed and peanut oils with commercial hexane are useful in the design of vacuum evaporators and strippers and for control operations involving temperature, time of heating, and concentration of oil-solvent mixtures of various compositions, to prevent or minimize fixation of objectionable coloring matter or other deteriorative heat effects. Boiling-point data are determined at various concentrations of crude cottonseed oil and crude peanut oil, over a range of pressures from 160 to 760 mm. absolute in commercial hexane. The effect of agitation in establishing equilibrium conditions of the oil-solvent mixtures is noted.

152. SPECTROPHOTOMETRIC ESTIMATION OF SOYBEAN OIL IN ADMIXTURE WITH COTTONSEED AND PEANUT OILS
O'Connor, R. T.; Heinzelman, D. C.; and Dollear, F. G.
Oil and Soap 22(10): 257-63. (1945)

This spectrophotometric method permits an accurate determination of linolenic acid in a mixture of soybean oil with either cottonseed or peanut oil for use as a criterion of the economic value of an oil mixture and as a guide in oil processing. The precision of the method is limited by variation in composition of the oils in the mixtures.

150. FOOD YEAST GROWTH OF PEANUT PROTEIN WASTE LIQUORS
Klatt, T. J.; Parker, E. D.; Pomes, A. F.; and Porges, N.
Oil and Soap 22(1): 319-21. (1945) (Reprints not available)

Peanut protein waste liquor supplemented only with an ammonium salt was an excellent medium for the propagation of the food yeasts, Torulopsis utilis, in batch and continuous processes. With nitrogen to give a carbon nitrogen ratio of 8:1, 100 grams of sugar yielded 48 grams of a high-protein yeast that was comparable in food value and vitamin content to food yeasts from other sources.

149. ELECTROPHORETIC INVESTIGATION OF PEANUT PROTEINS I. PEANUT MEAL EXTRACT, ARACHIN AND CONARACHIN
Irving, G. W., Jr.; Fontaine, T. D.; and Warner, R. C.
Arch. Biochem. 7: 475-89. (1945)

The homogeneity of peanut proteins and of arachin and conarachin was studied electrophoretically. Peanuts contain 2 major protein components in an approximately 7:1 ratio, totalling 87 percent of the protein content, and two minor components which occur in equal amounts. Arachin, comprising 63 percent of the protein, consists of both major components; conarachin, 33 percent, contains 80 percent of the major component and 20 percent minor components.

148. PURIFICATION AND PROPERTIES OF ARACHIN, A NEWLY DISCOVERED PROTEOLYTIC ENZYME OF THE PEANUT
Irving, G. W., Jr.; and Fontaine, T. D.
Arch. Biochem. 6: 351-64. (1945)

Purified solutions of arachin were prepared that are about 20 times more potent than those of peanut meal. Arachin is present in cotyledons and germs, but not in the skin. Common substances employed to activate most enzymes had no effect on the hydrolytic action of arachin on benzoyl-l-arginino amide.

146. DETERMINATION OF MOISTURE IN PEANUT KERNELS
Hoffpauir, C. L.
Oil and Soap 22(11): 283-86. (1945)

An investigation of conditions (time, temperature, and pressure) needed in oven methods of determining moisture in peanut kernels, to obtain the same values when using either whole or ground kernels and either 50-g. or 5-g. ground samples, indicated that original moisture should be determined on whole kernels and second moisture on 19-tooth or similarly ground kernels by heating for 5 hours in a forced draft oven at 130°C. Some values indicated that heating for 3 hours at that temperature may be adequate for the second moisture determination. This study provided the basis for the adoption by the American Oil Chemists' Society of the official method for the determination of moisture of peanuts and for the trading rules of the National Cottonseed Products Association for peanuts.

145. ELECTROPHORETIC INVESTIGATION OF PEANUT PROTEINS. II. COMPOSITION OF SEVERAL PEANUT PROTEIN FRACTIONS.
Fontaine, T. D.; Irving, G. W., Jr.; and Warner, R. C.
Arch. Biochem. 8: 239-49. (1945)

Electrophoretic analyses are presented of the protein preparations obtained by precipitation from peanut meal extracts at pH 4.5; of the small amount of the protein fraction remaining in the mother-liquor; and of the fractions obtained by precipitation from peanut meal extracts. Electrophoretic composition and physical properties and the high yields of these fractions which can be obtained, suggest the applicability of certain fractions in food products or in the preparation of adhesives and fibers.

144. IMPROVEMENT IN THE COLOR OF PEANUT AND COTTONSEED PROTEINS
Fontaine, T. D.; Detwiler, S. B., Jr.; and Irving, G. W., Jr.
Ind. Eng. Chem. 37: 1232-36. (1945)

Protein preparations as light or lighter in color than commercial samples of soybean protein can be obtained from the meals of white-skinned and blanched, red-skinned peanuts, without the use of bleaching agents. The color of proteins prepared from meals of unblanched red-skinned peanuts is improved through controlled protein extraction and precipitation techniques and by washing precipitates with organic solvents such as dioxane, acetone, and methyl ethyl ketone.

142. VISCOSITY PATTERNS OF PEANUT PROTEIN SOLUTIONS: COMPARISON WITH OTHER VEGETABLE PROTEINS AND WITH CASEIN
Burnett, R. S.; Roberts, E. J.; and Parker, E. D.
Ind. Eng. Chem. 37: 276-81. (1945)

Data are presented showing the influence on viscosity of peanut-protein solutions, made alkaline with sodium hydroxide, of concentration, heat, time, pH, and other factors, in turn affected by the methods employed in the preparation of the peanut meal and the separation and subsequent treatment of the protein. Viscosity behavior of solutions of peanut protein is compared with that of soybean and cottonseed proteins.

141. PEANUT PROTEIN HYDRATES. UTILIZATION AS TACKY AND REMOISTENING ADHESIVES
Burnett, R. S.; Parker, E. D.; and Roberts, E. J.
Ind. Eng. Chem. 37: 980-82. (1945)

Glues have been prepared from peanut protein isolated from solvent-extracted or hydraulic-pressed peanut meals, whose rewettability, tackiness, and flow properties make them suitable for purposes for which vegetable proteins have previously been considered unsuitable. Readily soluble glues can be prepared from isoelectric peanut protein curds by neutralizing the curds before they are dried. Dewatering curds to the amount of water in the hydrate reduces drying costs and provides a glue of relatively uniform ash content.

140. PEANUT PROTEIN HYDRATES. PREPARATION AND PROPERTIES
Burnett, R. S.
Ind. Eng. Chem. 37: 861-64. (1945)

Peanut protein hydrates, capable of binding increasing amounts of water, from 38 to about 70% by weight of the sol, as the pH value of the system is increased from 4.5 to 9.0, are tacky, and at pH values near neutrality have characteristics making them suitable for use as adhesives, provided the protein used is isolated from the meal with a minimum of alteration by heat or alkali.

80. SURVEY OF THE CHEMICAL COMPOSITION OF COTTON FIBERS, COTTONSEED, PEANUTS, AND SWEETPOTATOES. A LITERATURE REVIEW
Guthrie, J. D.; Hoffpauir, C. L.; Steiner, E. T.; and Stansbury, M. F.
U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-61. Processed.
86 pages. Revised 1949; 116 pp.
Peanut section republished under the title Chemical Composition of Peanuts: A literature review, Peanut J. and Nut World 24(6): 26-30. (1945)

This review, including 134 references on peanuts, has a two-fold purpose: To present information on the composition in a convenient and useful form, and to show where knowledge of the composition is inadequate or lacking--so that efforts can be made in utilization research to fill the gaps, since the composition of a commodity affects its uses. References on peanuts are discussed under these subject divisions: kernel and press cake; testa (skins); shells or hulls. This survey reveals that knowledge of the composition of peanuts (as of 1944) is inadequate.

105. VISCOSITIES AND DENSITIES OF HYDROGENATED PEANUT OILS
Magne, F. C.; and Wakeham, H.
Oil and Soap 21(12): 347-49. (1944)

Information on viscosities and densities of vegetable oils helps in the design of processing equipment and in research to extend the uses of these oils. Variations in viscosities and densities of unhydrogenated and hydrogenated peanut oils with variations in iodine value and temperature have been systematically investigated. Curves plotting viscosity versus temperature for oils of different iodine values were used to plot viscosity versus iodine value. These data may be applied in determining the viscosity of any refined or hydrogenated peanut oil of which the iodine value is known. The work confirmed that at a given temperature viscosity decreases with increasing iodine value.

99. RESEARCH ON PEANUTS AND PEANUT PRODUCTS AT THE SRRL
Markley, K. S.
Peanut J. and Nut World 14(1): 55, 57. (1944)

The history of the establishment of the 4 regional laboratories is traced, and the plant of SRRL is described and the following examples of its research are given: Research demonstrated that peanut oil can be hydrogenated so that part of it resembles olive oil in the properties required for use as a textile lubricant. The stability of peanut oil was improved; and data were obtained regarding thermal, dilatometric, and plastic properties of peanut oil. The influence of iodine number and temperature on the viscosity and density of refined and hydrogenated peanut oil was investigated, as a basis for use in the design of oil processing equipment. Certain methods for the analysis of peanut products were improved. The structure and composition of peanut meal and protein were investigated, and methods developed for making adhesives and a fiber from peanut protein. Peanut kernels were analyzed to determine the relation between U. S. Standards for farmers' stock peanuts and their chemical composition.

78. ANALYSES OF PEANUT KERNELS WITH RELATION TO U. S. STANDARDS FOR FARMERS' STOCK PEANUTS
Stansbury, M. F.; Guthrie, J. D.; and Hopper, T. H.
Oil and Soap 21(8): 239-47. (1944)

Analyses of peanut kernels of Spanish, Runner, and Virginia types (1942 crop) indicated that all peanuts of U. S. No. 1, No. 2, and No. 3 farmers' stock grades grown under similar environmental conditions will yield oil and nitrogen at almost the same rate in proportion to the total percentage of kernels after shelling; and the oil obtained from various lots of such peanuts will be of about the same quality from a refining standpoint. Reasonably small percentages of small shriveled kernels did not noticeably lower yield of oil and nitrogen, but samples composed entirely of small shriveled kernels contained only about three-fourths as much oil as did sound mature kernels. This study has resulted in trading of peanuts for oil milling on the basis of U. S. grades.

72. MOLECULARLY DISTILLED PEANUT OIL ANTIOXIDANTS AND PURE ALPHA-TOCOPHEROL AS STABILIZING AGENTS FOR FATS OF POOR KEEPING QUALITY
Oliver, G. D.; Singleton, W. S.; and Bailey, A. E.
Oil and Soap 21(7): 188-93. (1944)

Peanut oil, although not one of the richer sources of tocopherol, becomes extremely stable upon hydrogenation. Molecularly distilled concentrates of peanut oil antioxidants and pure alpha-tocopherol were tested as stabilizers of lard and of abnormal peanut oil products of poor stability. Neither the peanut oil concentrates nor alpha-tocopherol was effective in improving the stability of the abnormal peanut oils, indicating that poor keeping quality, when encountered, is not generally due simply to a deficiency in tocopherols or related antioxidants. Both alpha-tocopherol and peanut oil antioxidants stabilized lard in concentrations up to about 0.06 percent.

71. PROPERTIES OF PEANUT MEAL; INFLUENCE OF PROCESSING FACTORS
Fontaine, T. D.; Samuels, C. S.; and Irving, G. W.
Ind. Eng. Chem. 36: 625-27. (1944)

Specific information of interest to peanut processors is presented on the proper processing conditions under which sufficient oil can be removed with the least alteration in the meal proteins. Data are presented on the effects of temperature, humidity, and length of processing treatment on the peptizability of the nitrogenous constituents of solvent-extracted peanut meal and of flaked raw peanuts. The critical denaturation temperature for peanut protein in the meal, as measured by peptization, lies above 118° C. (dry heat) and above 80% relative humidity.

58. COMMERCIAL PEANUT MEAL; PEPTIZATION AND EXTRACTION OF NITROGENOUS CONSTITUENTS AND THE COLOR COMPARISON OF PROTEIN SOLUTIONS
Burnett, R. S.; and Fontaine, T. D.
Ind. Eng. Chem. 36: 284-88. (1944).

Industrial utilization of peanut meal and the separated protein depends on a knowledge of the properties of the nitrogenous and other constituents of

peanut meal as a prerequisite to the development of methods of modifying these properties to meet the requirements for particular uses. In this article data are presented to show that the nitrogen peptization values for peanut meals can be used as a practical guide in determining the amount of protein which can be separated from a meal. The relative spectral transmittances of peanut preparation in sodium hydroxide solution indicate that proteins of satisfactory color can be obtained from blanched, red-skinned peanuts and from unblanched, white-skinned peanuts. The practicability of using white-skinned varieties for industry uses is discussed.

51. ANTIOXYGENIC PROPERTIES OF MOLECULARLY DISTILLED FRACTIONS OF PEANUT OIL
Bailey, A. E.; Oliver, G. D.; Singleton, W. S.; and Fisher, G. S.
Oil and Soap 20(12): 251-55. (1943)

Through investigation of a refined peanut oil and the same oil hydrogenated to the degree to which hydrogenation is usually carried in the manufacture of commercial edible fat products, information was obtained on the extent to which the antioxidants of peanut oil can be separated by molecular distillation; on the stability of the oil at varying levels of antioxidant concentration; and the identify of the antioxidants.

46. MODIFICATION OF VEGETABLE OILS. I. NEW PRODUCTS BY FRACTIONAL CRYSTALLIZATION OF GLYCERIDES FROM PETROLEUM NAPHTHA
Bailey, A. E.; Feuge, R. O.; Kraemer, E. A.; and Bauer, S. T.
Oil & Soap 20: 120-32. 1943.

A variety of useful new products from cottonseed and peanut oils can be prepared under commercially feasible conditions by means of low temperature crystallization from petroleum solvents. Low ratios of solvent to oil were used. Crystallization was carried out at temperatures only moderately low, and the solvent used was one which is cheap and easily obtainable in large quantities. Crystallization was carried out in an agitated mixture of solvent and oil under conditions similar to those which would apply in commercial equipment. The laboratory equipment used was very similar to that suitable for large-scale continuous operation. The product is an oil of light color, little odor, and superior stability. It should be suitable as a replacement for olive, teaseed, neatsfoot and lard oil in a number of specialized uses.

42. EVALUATION OF THE MODIFIED RENARD AND KERR TESTS FOR THE DETERMINATION OF PEANUT OIL
Voorhies, S. T.; and Bauer, S. T.
Oil and Soap 20(9): 175-78. (1943) (Reprints not available)

In connection with cooperative work of the Fat Analysis Committee of the American Oil Chemists' Society, SRRL investigated the applicability of the Renard test, as modified by the Association of Official Agricultural Chemists, and the applicability of the Thomas and Yu modification of the magnesium-soap alcohol method of Kerr for the determination of peanut oil in admixtures with various other oils. The best results were obtained in analyses of mixtures of peanut-soybean oil, by the modified A.O.A.C. method,

but neither method appeared to be sufficiently accurate to warrant its use for the quantitative determination of peanut oil in vegetable oil mixtures.

38. POSSIBILITIES OF PEANUT, PECAN AND SAFFLOWER-SEED OILS AS SUPPLEMENTS FOR OLIVE OIL
    Bickford, W. G.; Mann, G. E.; and Markley, K. S.
    Oil and Soap 20(5): 85-89. (1943)

As part of research to develop a suitable substitute for olive oil, especially for use in the textile industry, the chemical and physical characteristics of these oils were investigated and compared with those of olive oil to learn whether any of these oils simulated olive oil in composition. Although the composition of a commercial, completely refined peanut oil did not resemble that of a commercial brand of imported olive oil, the peanut oil appeared capable of modification to form a product chemically similar to olive oil, and for certain purposes it could replace olive oil without modification.

31. VARIABLES AFFECTING THE YIELD OF NORMAL OLEIC ACID PRODUCED BY THE CATALYTIC HYDROGENATION OF COTTONSEED AND PEANUT OILS
    Bailey, A. E.; Feuge, R. O.; and Smith, B. A.
    Oil and Soap 19(10): 169-76. (1942)

Peanut oil is one of a large group of industrially important fats and oils that contain glycerides of oleic and linoleic acids and only negligible quantities of other unsaturated acids. To establish the conditions to be used in research for the laboratory hydrogenation of cottonseed and peanut oils to obtain the greatest yield of normal oleic acid and the least loss of potential oleic acid, these variables were investigated: temperature, concentration of catalyst, hydrogen pressure, and degree of agitation and nature of the nickel catalyst. Increasing the temperature, increasing the catalyst, decreasing the pressure, and decreasing the agitation of the catalyst favored the formation of iso-oleic acid, simultaneously repressing the formation of stearic acid. The nature of the nickel catalyst may affect the composition of the hydrogenated oil. Peanut oil is a more suitable raw material than cottonseed oil for the production of normal oleic acid because of its initially greater content of this acid and its lesser content of linoleic acid.

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